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BRIEFLY TOLD.

THE AUGUST MEETING OF THE SOCIETY OF GAS LIGHTING.—Colonel Fred. S. Benson, Secretary of the Society of Gas Lighting, has notified the members that the August meeting of the Society will be held at the "Squantum Club," the headquarters of which hospitable organization are not far from Providence, R. I., an announcement completely indicative that the hospitality this time, as in many past times, that awaits the Society in the East, is not providential, but is humanly directed by capable and whole-souled providers. The day named for the outing is Wednesday, August 11th, and those who propose to go to Squantum from the metropolitan district have arranged to travel on the steamer Massachusetts, which sails from pier 36, North river, at 5:30 P.M., of Tuesday, August 10th.

A HINT FROM THE SECRETARY OF THE AMERICAN GAS LIGHT ASSOCIATION.—The Committee of Arrangements of the American Gas Light Association, intrusted with the task—and task it is—of seeing to it that the Association will have plain sailing, in respect of its housing and entertainment, on the occasion of its 25th annual meeting, have triangulated a course that looks to be free from eddies, whirlpools, rapids or cascades. Last year, through some oddly conceived and acted on resolution, the Association voted to hold this year's meeting at Fortress Monroe, Old Point Comfort, Va., wherefore the Committee of Arrangements (Capt. W. H. White, Mr. Charles H. Dickey and Mr. William E. Helme), not having much latitude and less longitude, did the best they could. The result of their personal inspection of what Old Point affords seems about like this: The Hotel Chamberlin has been selected as headquarters and meeting place, and the sessions of the Association are to be held in the Chamberlin's dancing hall. The rates agreed to by the proprietors of the Chamberlin are: Room and bath, $4 per day; room without bath, $3—the card applying to single occupants. The American plan rules at the Chamberlin. The proprietors of the Hygeia Hotel have agreed to a similar schedule. The Committee have arranged for a banquet in the Chamberlin, on the evening of October 21st, and for an excursion on the historic waters of Hampton Roads and the James river on the following day. These diversions are contingent upon the number of subscriptions made by the members. No fault, of course, can be found with Fortress Monroe as a place for recuperation and rest, particularly at mid October; nor can there be any doubt as to the motive which prompted its choosing by the American Association for its quarter century tryst; still we are inclined to the belief that had New York been chosen—and in the order of things it was New York's turn this year—as the meeting place, the attendance would have been quite as numerous in the metropolis as it will be in and about historic Fortress Monroe.

PRESIDENT PARKER'S ADDRESS.—With this number we confidently expected to give a goodly instalment of the proceedings of the Fifth Annual Meeting of the Pacific Coast Gas Association, but delay in the forwarding of the stenographic report prevented. Elsewhere, however, in our pages of to-day will be found President Parker's address to the Association, and the paper, by Mr. John L. Howard, on "The

Spontaneous Ignition of Coal," as well. Reserving comment on the latter until the discussion thereon shall have come to hand, it may be said of the former that it is well worth reading. Having read it no student of it can fairly deny that Mr. Parker is a gas man ; and well to his credit be it said. Under the circumstances that prevail on the Pacific Coast in respect of the supply of artificial lighting from central stations, it takes quite a bit of courage to speak right out in meeting in advocacy of gas pure and simple. There are many small centers of population on the Coast, especially in the "California divide," where the joint operation of gas and electric lighting plants would seem to be the profitable and proper thing, and, in fact, where such operation has been followed as the proper thing ; but cold experience there, just as that experience has been gained much further east, goes to prove that, while joint operation may be the proper thing, the only profit that resulted from such operation came from the gas sales. Propriety being one thing and profit being another thing, the adjusting of the one to the other is a matter for those who have put in their money ; and so is a question for them alone to answer. But to come back to Mr. Parker's essential showing that he is a courageous gas man. That will be amply found in the third paragraph from the end of his address. There, in part, he says : "I hope too," [referring to the emblem or badge of the Association] "it will stand as a damper to the amalgamation of other interests in Association matters ; for all that we have, as well as all that we are, is the result of labor and thought in the gas business." The reference and expression seem to have been prophetic, for later on in the meeting the proposition was made that the "scope and rule" of the Association be "enlarged" to the point of causing its title to be changed to that of the Pacific Coast Gas and Electric Association, with all that such title would imply. In fact, we understand that such an amendment to the Association's constitution is now under consideration, to be acted upon finally next year. We hope and believe that the proposition will be soundly and roundly negatived ; for if the electric interest on the Pacific Coast is as large and as potent as it is claimed to be, there is no reason why its advocates should not maintain a live body of their own that would do it full honor and give to it that true support which they alone could offer it. The Pacific Coast Gas Association is no longer in the experimental stage nor in the embryonic state ; it is a firmly established body that time can do nothing other than strengthen, and in that knowledge we hope its membership will remain firm in their refusal to change in any word the title conferred upon it by its founders.

NOTES.—Mr. William S. Somerville, son of Mr. James Somerville, of Indianapolis, and recently in charge of the works of the Helena (Mont.) Power and Light Company, has accepted the position of Manager of the gas division of the St. John (N. B.) Street Railway Company.——The proprietors of the New London (Conn.) Gas and Electric Company are making notable extensions to the main system.——The capital stock of the St. Joseph (Mo.) Gas Company has been increased to $1,000,000. ——The annual meeting of the Ashland (Pa.) Gas Company resulted as follows : Directors, W. A. Marr, J. B. Price, Geo. Morgan, F. E. Heinze, A. Waldner, Frank Rentz, Jno. X. Dence, Chas. C. Graeber and H. F. Bright ; President and Manager, Jno. B. Price ; Secretary, J. X. Dence ; Treasurer, F. Rentz.——Colonel J. T. Gathright seems to be the head of the syndicate that is seeking control of the Louisville (Ky.) Gas Company. The price bid is $108 per share, and the depository named is the Louisville Trust Company. If the shareholders in the Louisville Gas Company are wise they will accept no such price for their holdings. The shares are easily worth $125.——The proprietors of the Elyria (O.) Gas and Water Company may shortly congratulate themselves over the possession of a completely rejuvenated works —— Mr. William Taylor, Secretary of the Wilmington (Del.) Coal Gas Company, informs us that the regular semi-annual dividend of $3 per share, for the past half year, is payable on demand.

Mixtures Containing Ethane.

The *Journal of Gas Lighting* says that in a paper submitted a short time ago to the Physical Society, Dr. Kennen described some experiments made in continuation of a research on the condensation and critical phenomena of mixtures of ethane and nitrous oxide, the results of which were published last year. The author has now investigated mixtures of ethane and acetylene, and of ethane and carbonic acid ; and he finds for them similar properties to those of mixtures of ethane and nitrous oxide. The first part of the paper referred to the preparation of ethane, and the effect of impurities on its vapor pressure, and critical constants. Ethane from ethyl iodide is not very pure ; it has generally an admixture of a substance of higher critical temperature and higher density than itself. This substance is probably butane. Ethane produced from sodic acetate by electrolysis is nearly pure. The method of preparation was described by the author. The pressure and corresponding volumes during condensation were given for this substance at various temperatures.

The Amsterdam Gas Works.

[A paper read by MR. HENRY H. SALOMONS, before the Incorporated Institution of Gas Engineers.]

The Institution of Gas Engineers having intimated through the Council their desire to pay a visit to Amsterdam this autumn, the author has thought it would be of interest to bring before this meeting a description of the works which he trusts he will have the pleasure of showing to a considerable number of the members.

Amsterdam had been lighted by the Imperial Continental Gas Association, under the name of the Amsterdamsche Pyp Gas Compagnie (this being the title of the native Company taken over by the Association), from 1834 up to 1845 exclusively ; and from that date in competition with a new native company. In 1883, the exclusive lighting of the town was put up to public tender ; and that of the Association was accepted. The Company undertook thereby a task of considerable magnitude. The concession was granted them on July 25, 1883, and by Nov. 1, 1885, gas had to be supplied to all the customers of the Dutch Company. This necessitated the building of large works for the supply of about 3½ million cubic feet per diem, the laying of a complicated system of mains throughout the whole city, to the length of some 147 miles, including the placing of some 40 mains under the canals, the crossing of some 172 bridges, the laying of some 11,000 services in wooden troughs filled with pitch, and the placing of some 10,000 meters and 5,000 lamp posts. The distribution work was successfully carried out by the firm of Messrs. John Aird & Sons, notwithstanding the treacherous soil of Amsterdam, and the necessity to keep clear of a double set of existing mains and services. In spite of all these difficulties, gas was supplied on Nov. 1, 1885 ; and by the middle of 1887, the second works was completed. The old works and mains of the Association were put out of action in the March of the latter year.

The Haarlemmerweg works (those first constructed) occupy an area of 14.5 hectares, equivalent to nearly 36 acres. The land being at the "polder" level, the greater part had to be filled up with sand to a height of nearly 8 feet. All the buildings rest on piles, as also the mains and connections. Some 25,000 piles were thus employed ; varying from 32½ to 42 feet in length, of which 4,448 are under the gasholder tanks, and 1,154 under the brick piers of the railway viaduct. For the buildings, 17,180,000 bricks were employed, and 4,500 tons of iron ; and for paving, 3,242,000 hard bricks, and 4,900 square yards of paving stones. The drains have a total length of some 2,900 yards. The first piles were driven on Aug. 8, 1883 ; and on Jan. 1, 1885, all the buildings were completed, excepting the dwelling houses, offices and workshops.

The works, which can be used separately in two sections, are bounded on one side by the railway, and on the other by a canal, along which runs a stone quay some 730 yards long. There is a high and low level line. The former enters the works by means of an iron viaduct supported on brick piers, which branches off right and left into the two sides of the stage retort houses. In the latter, the lines are carried upon wrought iron girders and columns, at a height of 13 feet above the stoking floors. The coal is stored under the viaducts, and in front thereof. In the coal stores placed on one side of the retort house, two lines also run, carried on wrought iron viaducts connected with the lines entering the retort houses by means of a traverser. On the coke floors of the retort houses are laid tram lines of 30 inch gauge, running to the canal for the purpose of loading barges ; all the coke from these works being taken away by water. Tram lines also run to the coke heaps, to the breakers, and to the different buildings. Between the two retort houses are placed the mess rooms and bath rooms for the stokers and foremen. In front of each retort house are galvanized iron buildings, in which are the coke breakers, worked by 5 horse power steam engines, separated from the former by glass partitions. The coke is raised by means of a "Jacob's ladder," and broken and screened.

No. 1 retort house is 297 feet long and 112 feet 6 inches broad, and contains in a line back to back 32 benches in blocks of 8, space being left for the construction of a further 8 benches. Of the 32 benches already built, 16 are regenerators with 9 retorts—8 of the Hasse-Didier, and 8 of the Munchener system—the remainder are firebar benches with 7 retorts, but built on arches so as to be easily convertible into regenerators.

No. 2 retort house is 291 feet long, and also 112 feet 6 inches broad. It is built for, and contains, back to back, 40 benches in blocks of 10. Of these, 10 are regenerators of the Munchener system with 9 retorts ; and the remainder fire-bar benches with 7 retorts, constructed in a manner similar to those of retort house No. 1. The hydraulic mains are of

wrought iron ⊔-shape, 2 feet by 2 feet, placed on the top of the benches. The mains of each block of benches are separate, and have at each end 9 inch outlets, which descend through the stoking floor under the arches of the coke vaults to separators outside, from which the tar and ammoniacal liquor flow into separate wooden tanks sunk in the ground. By means of steam pumps placed in the basement of the retort houses, the contents can be pumped therefrom into tar tanks on the banks of the canal, or into the liquor tank in the water tower. The gas rises from the separators through vertical pipes to cooling mains placed outside the whole length of the retort houses, and from which the gas passes through two 30-inch wrought iron mains, placed upon columns, across the yard to the condensers.

Between the high level railway and the retort house is placed a coal store or shed, composed of wrought iron columns and roof with galvanized iron covering. This store is 180 feet 6 inches long, 105 feet broad, and 24 feet 6 inches high; and can contain 8,500 tons of coal. Two railway lines run on iron viaducts through the whole length. Following this store, and of the same length but half the breadth, is another of the same construction, used as a general store, but arranged so as to be capable of being doubled in breadth and converted into a coal store by prolonging the railway viaducts through it. The annular condensers, supplied by Messrs. R. Dempster & Sons, consist of two batteries, one of 13, the other of 14 upright columns, 50 feet high, 4 feet outside diameter, and 3 feet 6 inches inside. From the condensers, the gas passes to the exhausters, three in number, supplied by Messrs. Gwynne & Co., coupled directly to 16-horse power steam engines, and each made to pass 80,000 cubic feet per hour. These are placed in a room 43 feet by 36 feet, with space for a fourth exhauster and the engine, for which the foundations are prepared. In an adjoining building are three Pelouze and Audouin condensers, for entirely freeing the gas from tar before it enters the scrubbers. Next to the Pelouze condensers or tar extractors is the pump room, in which are fixed 8 direct working Evans steam pumps in duplicate, for pumping water from the canal, tar, ammoniacal liquor, and for the service of the scrubbers. In the same building are placed four Cornish boilers, each with a heating surface of about 215 square feet, arranged to be fired with coke or by means of breeze with a forced draught.

The scrubbers are three in number, and were supplied by Messrs. R. Dempster & Sons, of Elland, and foundations are prepared for a fourth. They are 65 feet high and 12 feet in diameter, and filled with boards set on edge, placed in cross tiers. Fresh water is admitted at the top, and weak ammoniacal liquor at mid height.

There are two purifying houses, consisting of basements and upper floors, upon which are placed the purifiers supported upon rolled joists and wrought iron columns. The height of the upper floor from the basement is 6 feet 7 inches. The purifiers were supplied by the firm of Messrs. C. & W. Walker, and consist of four sets, two in each house; each set comprising 8 boxes, 20 feet square and 5 feet deep, with 5 tiers of grids.

The center valves and connections are situated in the basement, and thus easily accessible. The houses have wooden roofs covered with tiles, and with ventilating louvres running the whole length. They have on each side spacious revivifying sheds, 221 feet long by 39 feet 8 inches broad. The houses themselves are 221 feet long by 50 feet 6 inches broad; and the height from the floor of the upper stories to the crown of the roof is 45 feet 10 inches. The covers of the purifiers are raised and traversed by means of overhead travelling cranes, running on iron joists fixed along the side walls on brackets. At the end of each of the houses are stores, with iron roofs for storing and slaking lime, 77 feet by 65 feet 8 inches. Between the purifiers is an oxide store, 78 feet 10 inches by 65 feet 8 inches.

On each side of the building containing the exhausters, boilers, pumps and tar extractors, are placed the meter houses, in each of which are cylindrical meters from the Association's manufactory at Berlin, having a capacity of 85,000 cubic feet per hour.

There are three double-lift gasholders of 165 feet diameter, and each lift 20 feet deep, with 24 cast iron columns and one row of wrought iron girders. The tanks are of brick, and are 167 feet in diameter and 21 feet deep. Opposite the middle gasholder is a boiler house, containing two boilers, each with a heating surface of 215 square feet, fitted with a special arrangement for burning breeze, and used for keeping the tanks and cups of the gasholders free from ice. On the way to the gasholders are situated the two cottages, with gardens, of the foremen.

In the governor house, 29 feet 7 inches by 46 feet, are placed 6 Giroud governors—three upon each of the two 30-inch outlet mains. In this building there is also a small telephone exchange connected with all the different buildings on the works, and with the private line to the other works, as well as a telegraphic communicator with the head fire station in the town.

At the further extremity of the works is situated the ammonia plant, fitted with three sets of continuous apparatus for making sulphate on the system of Vorster and Gruneberg, with stores for sulphate and tanks for sulphuric acid. The stills are heated by direct firing by means of breeze, with a forced draught obtained from a fan worked by a 1-horse power gas engine. In the center of the works, and forming a prominent and picturesque feature thereof, is the water tower, in which are placed two iron reservoirs; one for water out of the canal for distribution throughout the works, and for the supply to 30 fire hydrants, and the other for ammoniacal liquor for supplying the ammonia works and scrubbers. The water tank is placed at a height of 70 feet. In the basement of the tower are stored two fire engines; and above is a room for the firemen.

Adjoining and above the offices are extensive workshops for smiths, carpenters, painters, etc., and for the repair and testing of meters. In the same building are also a photometer and testing rooms and a chemical laboratory; and at one end is the dwelling house of the assistant engineer. Near the entrance to the works is the dwelling house of the chief engineer. The works are approached by means of a double ascent on the opposite side of the canal, fronting the works, and leading to an iron bascule bridge crossing the water. This work had also to be carried out by the Association.

The Linneausstraat works are situated upon a considerably smaller piece of land than the Haarlemmerweg ones; the area being 8.5 hectares, or 21 acres. But nevertheless their productive powers can be brought up to the same figure. These works were commenced at the end of 1884, and put to work on July 1, 1887. They are connected with two lines of railway—the Dutch and the State; and one side of the site is bounded, as at the Haarlemmerweg, by a canal. The two railways enter the works at opposite ends, run along both sides of the works at low levels; and are connected behind the retort house by a traverser worked by hydraulic power. By means of three hydraulic lifts, the coal trucks are raised to the level of the three lines running on iron viaducts through the retort house; and, as at the Haarlemmerweg works, tram lines run from the coke floor to the canal to load barges, and throughout the whole of the works, for the conveyance of coke and breeze to the boilers, coke breakers, etc., and for the carriage of other material.

The site here also being at the "polder" level, had to be filled up with sand to a height of nearly 10 feet; and some 195,000 cubic meters of sand were employed for this purpose. Altogether 19,000 piles of from 10 to 13 meters in length were employed for the foundations of the different buildings, gasholder tanks, etc.; 2,600 being employed under the latter. On these works, in order to avoid having to go down with the foundations to the level of the polder water, and at the same time to keep the wooden floors always under water, the level of the latter was artificially raised by making openings in the banks of the canal running along one side of the works, the water being kept in on the other sides by means of wooden and clay dams.

Along the side of the retort house are placed the underground tar and ammoniacal liquor tanks, which, like those of the Haarlemmerweg works, are made of wood and caulked. Up to the present they have remained tight and in good condition. Tar is also stored in wrought iron reservoirs above ground on the banks of the canal. From these (after being freed as much as possible from water) it is loaded into barges by steam pumps placed in the basement of the retort horse, and which also pump the liquor from the wooden tanks into the reservoirs in the water tower.

The retort house is a stage one, and through it, as already mentioned, run three lines of rails on iron viaducts—the space underneath and in front forming the coal stores. Coal is also stored in the yard between the retort and purifying houses; trucks being run on lines leading from the traverser to between the heaps. This house is 304 feet long by 221 feet broad, and affords room for 80 benches in two lines back to back, and of which 56 are built; 26 being regenerator benches with nine retorts, 16 on the system of Munich, and 12 on that of Hasse-Didier. The remainder are fire-bar benches with seven retorts, but built upon arches in a similar manner to those previously described.

The hydraulic mains are of wrought iron of the ⊔ form, 2 feet broad by 2 feet deep, placed at the top of the benches, and supplied with Drory tar "take-offs," by means of which advantage is taken of the difference in the specific gravity between the tar and the ammoniacal liquor, so that the former flows off continually, and only the liquor stays in the mains. On leaving the hydraulic mains, the gas passes into wrought iron cooling mains, placed on the top of the benches, and

against the end outside walls of the retort house, and from thence to the condensers. These consist of two batteries of annular condensers, supplied by Messrs. C. & W. Walker, composed each of six upright columns, 50 feet high, of 4 feet outside diameter, and 3 feet 6 inches inside.

Since 1892, the hydraulic stoking machinery of Messrs. Foulis and Arrol has been successfully and successively introduced; and there are now in winter four drawing and four charging machines in use. Since September, 1894, no manual labor has been employed. The hoppers of the charging machines are filled by means of light hydraulic cranes attached to the machines; and the coal is broken so far as necessary by hand—circumstances not allowing of the erection of overhead hoppers, breakers, elevators, etc. Connected by a covered passage with the retort house on the ground level, is a building for the use of the stokers, containing a mess and reading room, and shower baths supplied with hot and cold water.

Parallel to one side of the retort house, and separated therefrom by a road, is placed a long series of contiguous buildings, containing the smithy (laboratory and photometer room above), carpenters' and other shops, stores, pump room, hydraulic accumulators and pumps, exhausters and boilers. The three exhausters, supplied by Messrs. B. Donkin & Co., are placed in a spacious room, 42 feet 9 inches by 40 feet 4 inches. They are coupled direct to 14-horse power horizontal steam engines. and are made to pass 125,000 cubic feet per hour. Foundations are built for a fourth exhauster and engine.

The two pumping engines of 36-horse power for the hydraulic machinery, and the two high pressure accumulators for the railway lifts and the low pressure one for the stoking machinery, are placed in a building 42 feet 9 inches by 27 feet 9 inches; the accumulators being in a separate compartment. The pump room is 42 feet by 13 feet 7 inches, and contains six direct acting steam pumps in duplicate, for pumping water, ammoniacal liquor, and tar, with foundations for the erection of two additional pumps. The boiler house—49 feet by 48 feet 9 inches—contains five Cornish boilers, fitted with Perret's grates, for burning breeze, and have each a heating surface of 490 square feet. From the exhausters the gas passes to the three tower scrubbers (foundations prepared for a fourth) erected by Messrs. C. & W. Walker. They are 12 feet diameter and 65 feet high. Two are filled with coke, and one with boards; and at the bottom of each is fitted Walker's patent washer.

The purifying house is a spacious building, 301 feet by 180 feet, including the side wings, for storing slaked lime and oxide of iron, and for revivifying the latter. The purifiers, erected by Messrs. C. & W. Walker, consist of two sets placed in two lines, each composed of eight boxes, 30 feet square and 6 feet deep; and they are placed on the ground level, with a basement underneath, by which the center valves, mains and connections are easily accessible. The covers of the purifiers are raised and moved by means of two "Goliath" travelling cranes, running on rails placed on the floor.

The meter house is 72 feet 8 inches by 36 feet 8 inches, and contains two square meters, erected by the Gas Meter Company, Limited, made to pass 120,000 cubic feet per hour. Space is left between the two existing meters for the erection of a third of the same size.

The two triple lift gasholders were erected by Messrs. S. Cutler & Sons, and are 150 feet in diameter. The inner lifts are 25 feet 6 inches deep, and the other two, 25 feet. Each gasholder has 16 cast iron columns, with two rows of wrought iron lattice girders. The tanks are of brick, encircled with six iron rings, 7 inches by 1¼ inches, and are 152 feet in diameter and 26 feet deep.

On the street side of the works is situated the governor house, 40 feet 7 inches by 29 feet 2 inches, and containing two of Parkinson's double cone governors, connected with the two 30-inch outlet mains from the works. In this building is also the telephone exchange, connected with all the buildings on the works, offices, engineer's dwelling house, etc., and the private line between the two works. In this building is also telegraphic communication with the head town fire station. At one corner of the works, fronting the street, is situated the dwelling house of the engineer; and at the opposite corner, the offices, with dwelling above for the assistant engineer. Between this latter building and the workshops is the foreman's house. Behind the scrubbers is placed the water tower, 82 feet high, and containing tanks for ammoniacal liquor and water from the canal and from the town supply.

At the extremity of the works, beyond the gasholders, are the sulphate of ammonia works, fitted with two sets of apparatus on the continuous system of Dr. Feldmann; space being provided for the erection of a third. The apparatus of Dr. Feldmann has given great satisfaction, and although much more compact and taking up less room than the three sets of Vorster and Gruneberg at the Haarlemmerweg works, they have the same capacity, and produce if anything salt of a better color.

Adjoining the sulphate works is a boiler house containing two Cornish boilers, fitted with Perret grates for firing by means of breeze. These boilers (each with a heating surface of 377 square feet) are employed for the distillation of the ammoniacal liquor, and for keeping the gasholders and tanks free from ice in winter. In the neighborhood of the sulphate works are sulphate stores and tanks for storing sulphuric acid, which is delivered direct from the tank trucks.

For some time, at both works, the use of cannel for enrichment has been almost entirely discontinued, and replaced by carburine and benzol. In spite of the exceptionally bad soil and the number of water mains and bridges to be crossed, the leakage at Amsterdam is very small—thanks to the great care taken in laying the whole system of mains. Very full lead joints were made, and the principle was adopted of making use of no mains of less than 4 inches diameter, of laying in every street mains on both sides, and of laying all services in wooden troughs in pitch. All mains, before being covered in, were tested under a pressure of 20 inches. Constant attention is also paid to detect leaks; all mains crossing bridges and leading to water mains being systematically inspected annually.

It is also a rule that no work for drainage or other purposes shall be carried on in the streets without someone from the works being in attendance; while tests also are constantly made with chloride of palladium. From all mains laid in streets with asphalt covering, iron ventilating pipes run to the edge of the foot pavements, and these pipes are also tested from time to time for leaks. Two 30-inch mains, uniting the two works, traverse the town on both sides, and are connected by mains of from 9 inches to 16 inches diameter. The capacity of the system is so ample that the highest pressure required to be given at the works is some 16-10ths, and all over the town the pressure is then about 13-10ths.

The total length of mains at present is nearly 187 miles, and the number of public lights is some 6,700. The architect of both works was Mr. J. Gosschalk, of Amsterdam. The Haarlemmerweg works were commenced under the engineership of the late Mr. Miltner, and were completed by the late Mr. J. Pazzani, C.E., who was also engineer for the Linneausstraat works.

On the Keizersgracht and Prinsengracht, covering nearly a quarter of an acre, are situated the central offices and the workshops, fittings, stores, etc., for the carrying out of work in the town; a considerable fittings business being done by the Association. In the same building as the offices, are photometer and testing rooms, a laboratory and a show room.

The Lighting of Isolated Railroad Stations.[1]

The principal disadvantages of separate lamps with glass reservoirs for the lighting of stations are the amount of labor they require in filling and cleaning, their small illuminating power and the liability of disastrous fires resulting from accidental breakage. Even with oil of a high flash point the danger of conflagration is not entirely avoided. Such small flat flame lamps usually burn about 0.01 gallon of oil per hour, corresponding to a candle power of about seven, and an expenditure of 0.06 cent for oil. Now, as the candle power of ordinary flat flame gas burners is from 10 to 20, we see that such stations are comparatively poorly lighted by the small lamps. The labor involved is considerable, as the lamps must be filled every alternate day, the wick trimmed and globe cleaned, which consumes nearly half a day in stations using over 30 lamps.

Gasoline plants are expensive to run and liable to explosion when not properly handled. Gas and electricity are not to be considered for isolated stations, as small plants are so very expensive as to be out of the question from economical considerations alone, and as a result railways have been employing separate lamps at their country stations almost exclusively.

While passing along the line of the New York, New Haven and Hartford Railroad, a system was noticed which seemed new, and through the courtesy of Mr. Wilson, Chief Train Dispatcher, we are able to present some figures of interest to railroad men on a connected lamp system of oil lighting. Although this system has been known for probably 15 years, it is not more than 4 years ago that it received its first application on railroads, and, as far as the writer can determine, this road is the only one using such a system at the present time.

The types which have been put on the market may be classified as follows:

1. From *American Engineer and Railroad Journal.*

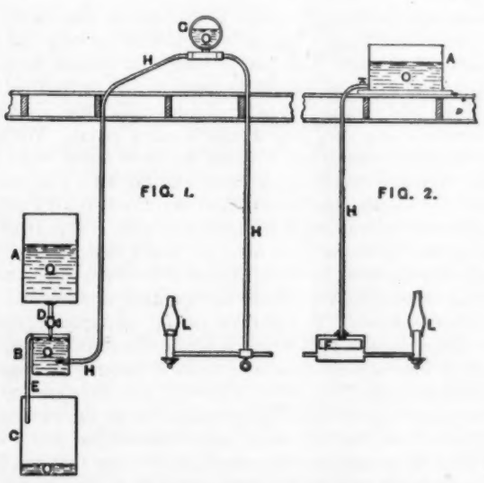
I. Reservoir on a level with the lamps.
  a. Underneath system of piping.
  b. Overhead or siphon system of piping.
    1. With siphon air collector.
    2. With pump siphon renewer.

II. Reservoir placed above the lamps.
  a. Flow of oil regulated by valve and float.
  b. " " " " mercury and float.

A brief review of this classification will lead to a better appreciation of the system in general. The first system is shown in diagram in Fig. 1. The reservoirs are made of galvanized iron, which are carefully soldered and very rarely leak. Reservoir *A* is filled, while inverted, through the opening made by removing the pipe *D*, and is again replaced as shown. *B* is a stationary reservoir having a constant level of oil which enters through *D*, escapes to the lamps through *H* or overflows by *B* into *C*. The top of the oil is about 2 inches below the level of the top of the wick—all lamps being on the same level. When the level of oil in *B* falls below the end of *D* it permits air to enter *A* through *D* and allows an equivalent quantity of oil to flow out. This automatic arrangement works very well. In underneath piping, the pipes *H* run down to and under the floor and up the sides of the room or post; here there is pressure in the pipes and leakage may occur.

In running the pipes overhead by the siphon system the air tends to enter any orifice in the pipes instead of the oil flowing out, so that there is no trouble from oozing oil. All air tending to break the continuity of flow collects in the highest point of a siphon, and a small reservoir is placed here to catch the air. When nearly filled with air the globe *G* is inverted, which shuts off both branches, the globe screwed off, filled with oil, replaced and returned to position as shown. This must be done once a week.

Another lamp re-establishes a siphon by having parallel pipes, and when the flow ceases, a small plunger pump situated in *B* forces oil through one pipe and back through the other, carrying the troublesome air along with it. The pipe *H* ends at the foot of the chandelier in a spring cone valve. When the chandelier is in position for burning, the stem of this valve is pushed up by the bottom of the T connection, allowing the oil to flow freely; when the chandelier is pulled down, a spring seats the valve and stops the flow of oil. This oil pipe runs inside the chandelier stem and packing is placed between the two. Argand burner lamps with 5 inch circumference wicks complete the outfit. These lamps are usually provided with central draft and have their wicks raised by several methods in common use; drip cups are necessary with all forms. For outside use the underneath system may be employed, as it does away with any attention required by the siphon, although the other is preferable where the possible stains or odor of oil



A, Supply reservoir; *B*, Feed reservoir; *C*, Overflow tank; *D*, Supply nozzle; *E*, Overflow pipe; *F*, Admission float; *G*, Glass bulb air collector; *H*, Oil pipe; *L*, Lamps.

would be objectionable. This system is cleanly and is so much liked that a score of stations on the New Haven road have it in daily operation.

When the reservoir is placed above the lamps, the lamps can be placed on any level below it, which is of considerable advantage, although not a necessity in station lighting. In the previously mentioned class separate reservoirs were necessary for each level, of which there are three, in the case of the outfit at Riverside. When oil is placed under pressure, however, it is difficult to confine it and this is the trouble with this class of distribution. Each lamp or cluster of lamps has its individual reservoir, which contains a float operating a valve, seal, or other device to close the oil supply pipe when this small reservoir is filled to the required height. In Fig. 4 will be seen a device by which the float *F* forces a mask of a certain composition against the end of the fixed supply pipe. This is in use at Greenwich and Stratford stations, and although they furnish a satisfactory light there is sufficient dripping to cause annoyance, and the lamps sometimes are fed too strongly by imperfect action of the valve, causing smoke and excessive consumption of oil. This device is replaced by another firm by a conical valve on a triple seat which is pushed up when the float falls. Such mechanical devices are not satisfactory in general.

Another device, Fig. 6, in the form of a mercury seal is in operation in this country and, as shown in Fig. 5, in England. In both cases as the float *F* falls the head of mercury *H* outside the oil feed pipe *C* falls also. If this head of mercury is so adjusted as to exactly balance the

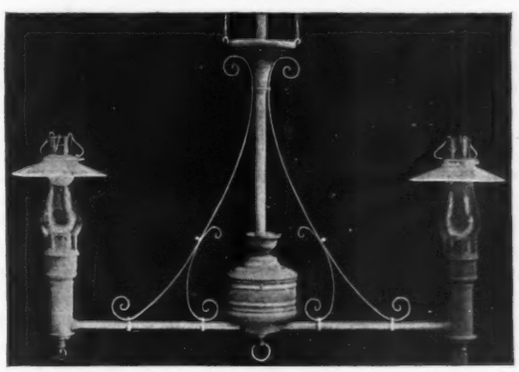
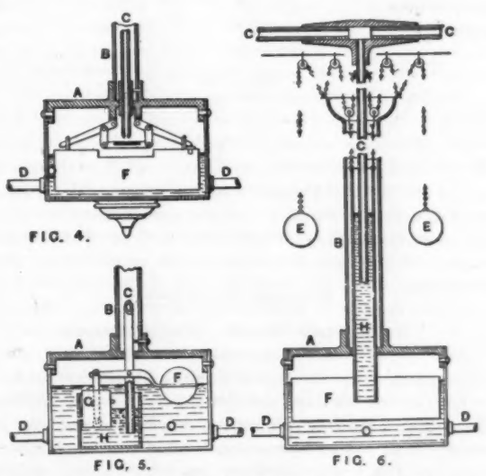


Fig. 3.—Plain Oil Lamp Chandelier.

head of the oil from the reservoir above, the oil will flow out of the end of the pipe as soon as the head of mercury becomes less, and will cease flowing when the original level is attained. This valve works well and gives satisfaction, according to the statements of those who use it. The same remarks on oil under pressure hold good here also, and the system is slightly defective, especially as the head above the lamps is not constant while the reservoir is becoming empty.

The class first described has given the best satisfaction, not only in small stations but in more pretentious ones, as at Meriden, where 38 lamps are used, where the price of gas is $1.80 per 1,000 feet, and the



A, Small reservoir; *B*, Stem of chandelier; *C*, Oil pipe; *D*, Pipe to burners; *E*, Counter weights; *F*, Air-tight floats; *G*, Hollow plunger; *H*, Mercury; *O*, Oil.

railroad preferred to use oil to being imposed upon. At the time the lamps were put in gas was selling at not far from $2.50 per 1,000 cubic feet, and the electric light company controlled both gas and electric lighting. As the consumption of oil at this station is but about 50 barrels per year the siege will probably last some time into the future.

Mr. Julien Lefevre stated before the French Association for the Advancement of Science that 30 grams of kerosene oil were burned per *carcel-heure*, which is equivalent to 0.00135 gallons per candle power.

Professor Jacobus before the Franklin Institute said that his experiments indicated that a 16-candle power lamp would consume 0.022 gallon of oil per hour, equivalent to 0.00137 gallon per candle per hour. These figures from widely differing sources agree very well, and one could with safety assume the mean, 0.00136, as the basis for calculation. Assume that 0.25 cubic feet of illuminating gas are consumed per candle power per hour; take the price of gas in small towns at $1.75 per 1,000 feet, the cost of oil at 8 cents per gallon and incandescent electric light at 1 cent per hour per 16-candle power; then we have the following comparison of three methods of lighting stations:

One candle power from	Consumption per hour.	Cost per hour, cent.
Incandescent electric lamps.....	0.006 horse power	0.0625
Illuminating gas.....	0.25 cubic foot	0.04375
Kerosene oil.....	0.00136 gallon	0.01088

The item of cost must be settled by local conditions. At Wallingford station the oil lighting system displaced gas. The candle power claimed for these lamps is about 38 × 0.00136 = 0.05168 gallon per lamp hour. The actual quantity of oil burned per lamp hour is difficult to secure as no detail records are kept. Meriden uses 5 to 6 barrels (52 gallons each) in midwinter and three barrels in midsummer; there are 38 lamps in use of which 11 are outside. Making an approximate calculation of hours of burning, the consumption of these lamps is 0.02 gallon per lamp hour.

At Riverside station two barrels of oil are used per month. Of this about 30 gallons are used on switch and tower lights, 16 gallons are burned in seven separate flat wick glass reservoir lamps (0.01 gallon per lamp hour). Three outside and five inside Argand lamps are in constant use, although there is a total of 17 of these lamps at the station, some of which are lit but part of the time. The Argand burners connected in the overhead siphon system, consume 58 gallons of oil per month. A close calculation shows that this is equivalent 0.03 gallons per lamp hour. A store using six lamps reported a consumption which indicated 0.038 gallon per lamp hour used. The manufacturer claims a consumption of 0.042 gallon, corresponding to about 31-candle power, although he claims 38 candle power. Another make of lamp at Greenwich consumes relatively one-fifth more oil than those at Riverside station, partly by reason of the reservoir being at a higher level, and also on account of a greater candle power. Such are the results from practice, which indicate that the candle power lies between 20 and 30, much greater than any single gas burner usually employed.

The following is the relative consumption and cost of lighting of several stations with oil and gas:

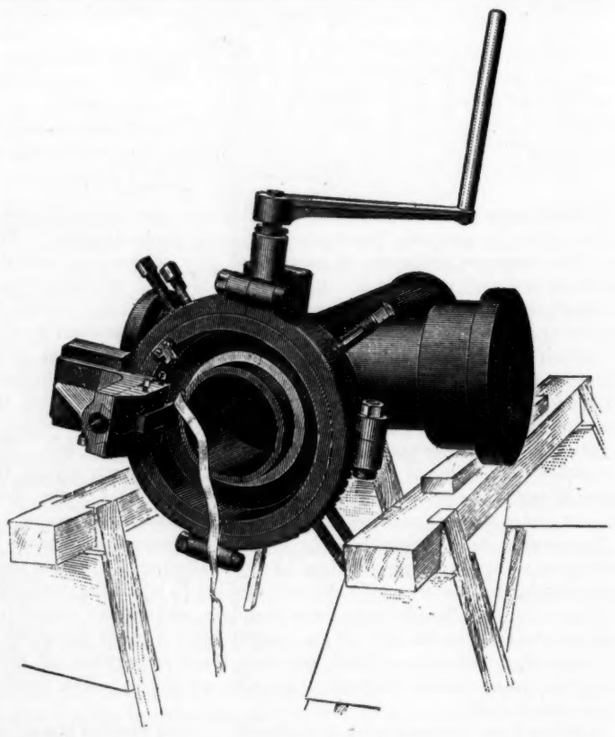
Gas Jets.	Number of Burners.	Monthly average for the year 1896. Cubic Feet.	Gas Bill.
Pelham.....	20	7,100	$10.65
Mamaroneck.....	11	6,200	10.85
Rye.....	7	5,200	9.10

Oil Argand Lamps.	Number of Lamps.	Approximate Monthly Average for Year 1896. Barrels.	Oil Bill.
Meriden.....	38	4.5	$18.00
Greenwich.....	31	4.5	18.00
Riverside.....	17	1.5	6.00

Even if we assume that the gas jet would give an illumination equivalent to an Argand oil lamp and that the same proportion of illumination hours would hold for each lamp and jet, yet the cost of oil compared with that of gas would be in the ratio of 50 to 80 cents per light per month.

The French Lead Joint Remover.

The accompanying illustration shows the French patent lead join remover, which is manufactured by Benjamin C. Smith, 275 Pearl street, New York. Heretofore, in disconnecting a heavy cast iron water pipe used for water and gas service, considerable time and material have been wasted in the work. Ordinarily the lead in the joints is wasted to a large extent, owing to its being melted from the joint by having a fire built around the pipe. This takes a great deal of time, and oftentimes swells the bell end to abnormal proportions, and in some instances the bell ends are split from unequal expansion. This machine is made in two parts, and designed to be clamped tightly around the pipe. It is provided with a cutter which slowly feeds into the lead in the joint as the cutter revolves around the pipe, cutting off a ribbon shaving of lead at each revolution, so that the lead may be readily saved clean and fit for use, and removes the joint in a very short time. The machine is adapted for removing lead from gate valves and the



various fittings used on cast iron pipe work, and also obviates all danger of destroying large valves by overheating them. The machine operates with very little power, and its action and application are so simple that the ordinary workman uses it successfully. It is made in three sizes, for use on pipe from 4 to 16 inches in diameter.

Tests of Blowing Fans under Different Conditions and of Different Makes.[1]

Mr. President and Gentlemen: I found that I would not be able to give the necessary time to the completion of a paper to read to you, and so to-night I shall simply give you a short talk covering the nature of the investigation which we have made at Cornell University, and the general result.

Two years ago, in connection with the subject of ventilation, we commenced a study of different fans in order to find not only the efficiency of the various fans made, but also to find what shapes gave the best results and what were the conditions necessary to be fulfilled in order to produce the best results. When we undertook this investigation I thought it would be a very easy matter to carry it out. We have been at it now for three years, and I think we have tested some seven or eight fans. We have tested an experimental fan which we built, in various ways and shapes, and we still find that there is very much more to be done before we can make a complete report. I think the question is of a great deal of importance to us all, and I believe there is no machine built anywhere in the world that is of as much importance as the blowing fan that has been so little investigated, and regarding which there is so little known. It is also of special importance, since, if we are in the dim future or in the near future to ventilate our buildings, we must do it by some sort of fans, and hence it becomes necessary to get exact knowledge regarding them. I think if you have erected fans and have taken data from the catalogues published by the various makers, that you have found the results actually obtained practically were quite different from those stated in the catalogue; at least that has become so trite a saying that I suppose the statement will pass unchallenged. In fact, I think you will find—and this I do not know to be certain in regard to all fan catalogues, because I did not investigate all of them—that the figures in the fan catalogues which show the capacity of the fans and how much air can be moved require a fan of 100 per cent. efficiency—a perfect fan. I might say that not only never has such a fan been built, but it is impossible to build one, from theoretical reasons, too, as well as practical ones. Hence it is absolutely impossible to attain the results which are given in certain fan catalogues, and possibly

1. By Prof. R. C. Carpenter before the last meeting of the American Society of Heating and Ventilating Engineers.

in all of them. But, on the other hand, I do not want you to think that the fan people do not know that. Consequently, when they sell you a fan they usually give you private information which is much more accurate than that which is published.

Two Types of Fans.—If you have looked into the subject of fans you will have noticed, of course, that there are two very distinct types sold. These are sold, I believe, for distinct purposes, and rarely come into competition. One we will call the disk fan, in which the air is received at one side and carried right through the fan and discharged in parallel directions with the axis. The other is more commonly called the blower or centrifugal fan, in which the air is discharged from the edges of the blades and then carried off by pipes or some other arrange ment. The disk fans are, I think, never put in for pressure fans—that is, they are not used in places where air under pressure is required. They are generally used in places where air needs to be moved from a room and discharged into the open air—exhausting purposes principally —and this work they do very nicely. The other class of fans is used both for exhausting air and for discharging air into pipes—that is, for moving air under pressure. The air in the centrifugal fan is received at the center of the blades, and by their motion it is thrown to the outside of the fan and discharged outward. This was ascertained some years ago regarding suction fans, I think by Gibbeau, a Frenchman—namely, that if he attached a chimney to his exhaust fan he increased the efficiency very much, almost doubling it—that is, if you take an exhaust fan and discharge the air it would require a certain amount of work to move a certain amount of air. If, on the other hand, you construct from that fan a tapering chimney, you will discharge with the same amount of work very nearly double the amount of air. This principle, as it was stated by Gibbeau, has been verified and is known to be true. It applies only to suction fans. It shows that the chimney is a very useful adjunct indeed to such a fan. In this country I believe the chimney has not been used, except, it may be, in fans constructed for ventilating purposes; and, by the way, you should all know that the mining engineers are the men who have had the most experience with fans. They have had to use fans to ventilate the mines, and it was from their practice that this fact was learned.

Pressure Fans.—In regard to pressure fans—that is, the fans which deliver the air from the tips of the blades—it was found that the efficiency was very much increased if the casing was made considerably larger than the fan. If you run a fan with a casing very close to the blades you will find that it requires very much more work to move a certain amount of air than if that casing be some considerable distance from the fan, and this has been found to be true in regard to centrifugal pumps for pumping water. The reason for this is that the air is thrown out entirely by centrifugal force. The particles of air strike the blade and are projected. If there be not room at the end of the blades not only for the air to be stored, but to get rid of its whirling motion, there will be a considerable loss of efficiency, and it has been found that in order to give the best result the area at the end of the cas ing should be about equal in length to the length of the blade of the fan.

In regard to our experiments I will say that we started out two years ago, first, by testing one of the commercial fans, afterward by constructing an experimental fan, and then putting the greater portion of our work on the experimental fan. The experimental fan was in some respects very much like the commercial fan, but we built it in such a manner that we could vary the shape and size of the blades and also the form and size of the casings, these being the important things. Then we made various experiments under different conditions in order to ascertain under what conditions we obtained the best efficiencies, and then we verified some of the things we found out later. I will not trouble you with all the details, but I may mention we found that a fan with straight radial blades would perhaps move the most air for a given diameter. That is, a 48 inch fan, with the blades slightly bent at the inner sides, would move the most air; but we found that when we curved the tips of the blades backward with the inner edges running a little forward, we got the highest efficiency. That is, for the same amount of power applied we got the most air moved, although for the same diameter the other style of fan would move the most air. We also found, in regard to the casing, what I have practically announced as a general principle—that is, that the casing at the end of the fan, in order to give the best results, must be away fully the length of the blade, otherwise it will affect the result seriously. One other thing, we found this—which d'ffers from what has generally been announced regarding fans, at least in the different makers' catalogues, and I feel very certain that it is true, because it was not only true in respect to our experimental fan, but it has been found to be true of commercial fans that we tested —that the efficiency increased with the speed of the fan up to a certain size and up to a speed which gave us a pressure of about 2½ inches of water measured by the manometer. There was a falling off in efficiency below that. That speed corresponds in all fans to a speed of about 6,200 feet per minute of the tip of the fan, and if we ran any of the fans slower than that there was a falling off in the efficiency, and if we ran them much faster there was a falling off in efficiency. If you will look in fan makers' catalogues, I think you will find that you can move a great deal more air with a great deal less power if you run the fans at a much lower speed than I have given. Their statement does not seem to me correct. We found that by increasing the speed of the fan we moved more air with less power up to that point, and we found, further, that it was more economical to keep a considerable pressure and let the fan work against a pressure corresponding to something over an ounce, or, say, 2½ inches of water, than to work freely against the air. I speak of these points because they are points which have not been considered good practice; and, too, in the putting in of a forced blast system it has been thought best to keep the velocity and pressure down very low. Consequently, this shows that in this respect our practice has not been leading to the very best efficiency.

Measuring Velocities.—In connection with efficiencies I should like to say a word or two about measuring the velocities of air. If you take up this system of ventilation, as perhaps you all may very soon, you must know how to measure air, and I tell you it is the most difficult thing to measure that you ever had anything to do with. You may get a great deal of practice in measuring it, and from the very fact that we cannot see it you will find that it is very hard stuff to handle. It does not move with uniform velocity in the pipe, and that has made more trouble for us than anything else. I have been looking over some old fan tests where the efficiency ran over 120 per cent.; that is, where the actual work of moving the air was 20 per cent. higher than that done by the engine driving the fan. This test was made in a report by Professor Trowbridge. Now, what does that mean? It means that he made a mistake in measuring the air. If you will use some instrument you will find that the air is moving five or six times faster in some places in the pipe than it is at other places in the pipe, and if you stick in your measuring tube in that spot where it is moving faster and figure on that you will have a remarkably good efficiency. On the other hand, if you will take care and put your anemometer successively in all portions of the pipe, the results will not come out anywhere near that. There was another thing which troubled us, viz., the anemometers. We have three of them, one a brand new one, which came to us fully certified that it was perfectly correct, but I found on comparing it with the one we called standard last year there was 40 per cent, difference, and between it and the one we called standard the year before there was about 20 per cent. difference. So there was trouble right away. Then we set out to standardize the instruments ourselves, and, I might say, the result showed that they were all wrong. The method we used to standardize the instruments was to swing them around through the air on a long pole. Knowing the circumference of the circle, and the number of revolutions made you have the distance it travels, and if it moves through perfectly still air the supposition is that the air would produce the same result in every case. This is the method usually adopted, to which, of course, there are, some theoretical objections. Moving the anemometer through the air is not really the same as having the air moved through the anemometer.

Another method which was used for calibrating the anemometer, and which was finally adopted as giving the best results, was to check its readings by blowing the air through a large tube in which a steam pipe was so arranged that all the heat given off by the steam pipe must be taken up by the air; in which case, if the number of heat units calculated as having been absorbed by the air (temperature, volume and velocity being the three factors of this calculation) was the same as the amount determined as having been emitted by the condensed steam, the reading of the anemometer was taken as being correct.

Efficiency of Fans.—I might say that the highest possible efficiency of a fan delivering air without a casing is not over 50 per cent.—that is, theoretically—because there are theoretical losses which are equal to 50 per cent. of the total work put in. Consequently we know that we cannot get very high results. By putting on a casing and putting on the chimney it may possibly be brought up to 75 or 80 per cent., although it is very doubtful, I think, if anything has passed 80 per cent.

With the pressure blowers we got quite uniformly the same results with all the different types. That is, with three different fans, and at the speed of which I spoke, we got an efficiency that ran from 32 to 47 per cent., varying with the conditions, 47 per cent being the very best. In order to get that we had to construct our experimental fan prac-

tically with square blades almost exactly like the commercial fan of that diameter, and we gave it a single inlet (22 inches in diameter) taking in all the air from one side and delivering it at the other side. With that condition the best efficiency we could get, even at the best speed, was about 35 per cent. Afterward we made a double inlet—that is, put an inlet in the opposite side of the fan—and simply the changing of the inlet increased the efficiency of the fan from 35 to 47 per cent., which shows that the rectangular fan supplied by air at the center on a single side cannot get a sufficient supply to keep the casing and all of the parts full; and it would also point as a probable improvement on fans, that if we were to make the fan slightly conical—that is, make it larger near the center than at the outside, by means of which we could admit more air through a given sized hole; that is, if our entrance in proportion to our discharge orifice was made larger—it would no doubt increase the efficiency. This was ascertained some years ago, but I think it has been overlooked by our manufacturers generally, because I know of no American fans built with the conical case, although some foreign fans have been built that way.

I think that from 35 to 47 per cent. is just about the commercial efficiency of fans run under the best conditions. In proof of this proposition I might say that I have looked over a large number of tests, and I believe in hardly any case did I find that the efficiency had been higher. It has gone as high as 47 per cent. only in such cases where the inlet was made double or the passage for the entrance of air was made very large indeed. Practically this would mean that if the catalogue tables are based on the 100 per cent. efficiency we must multiply the air by just about three in order to find the power necessary to drive a given fan as printed in a given catalogue. We went further than this and tested a few fans that were running in buildings, and which were used in connection with hot blast, or the hot and cold blast system of heating and ventilating. In all these cases we found the fan efficiencies very much lower than those which I have given you, or, in other words, we found that the fans were running very much too slow, and the efficiency, instead of running up around 25 per cent., ran under 20 per cent., and yet the fans were perfectly capable of returning a very great deal more for the power put into them.

Speed.—It seems to me from our investigations that there can be no very great objection to increased speed except in such cases where noise is objectionable; of course you understand that the noise will always increase with the speed. I think we should all endeavor to ascertain at what speed a fan gives the very best results.

In addition I might say that we found the following propositions to be true: 1. That the amount of air moved by a given fan would vary directly with its speed—that is, if you turn it over twice as fast it will throw out twice as much air; 2, we found that the work required to move the fan varied with the cube of the speed; 3, we also found, as an interesting fact, that if we take and form an equation of which the peripheral speed in feet per second—that is, the speed of the tips of the fans—is put on one side, that number was equal, in practically all our experiments, to 47 times the square root of the highest pressure, expressed in inches of water—that is, about three-quarters of the peripheral. In other words, we found that the highest pressure we could produce was about three-quarters of the theoretical, and the highest pressure can always be produced when there is no air being discharged from the fan. When there is air being discharged from the fan there will always be a less pressure than the highest, because the two things together constitute the total work of the fan.

Then there was one other useful point, which, from the fact of its being of some interest, we noticed—viz., the relation of the velocity of the tips of the fan to the velocity of the air that was driven off. I want to tell you that there is no relation between them. The whole matter rests upon this fact: If you allow a pressure to accumulate in front of your fan, as you may do by holding the air back, and then let that air discharge freely afterward, it will go down hill at any rate whatever and may travel three or four times as fast as the tips of the fan.

Disk Fans.—In regard to disk fans, the efficiency runs lower. We did not get as high an efficiency in a single case with a disk fan. I think they must necessarily run lower. More than that, just as soon as we got them working against any pressure the efficiency almost entirely fell off—that is, we were turning the fan around and moving very little air. Yet the disk fan is very much better suited for certain classes of work. In making this statement of course it is not to be understood as at all derogatory to the disk fan. They are two classes by themselves, one used for one purpose and the other for another purpose.

Practically, then, the way our investigation stands at the present time is that about the best efficiency we can get out of the blower fan is about 35 per cent. with the single inlet, or, through a double inlet, about 10 per cent. better. That may seem to you to be more extravagant than ventilation by means of chimneys. I think we discussed that at our meeting last winter, and the table I gave you there was figured out on a supposed fan efficiency of 25 per cent., and perhaps you may remember that the fan then came out, even when I used a very wasteful engine, 50 times as economical as a chimney 100 feet high. If, instead of the fan being 25 per cent., it is 33 per cent., of course our fan then becomes 75 times, instead of 50 times, cheaper than a chimney. In other words, we cannot afford, even though our fan is inefficient, to ventilate by heat. We must afford to ventilate by power. Mechanical ventilation is the ventilation which is coming, and which we must learn to handle; and it is coming because it is more efficient, because it is cheaper, because it is more positive, because it is more certain and sure to give the very best results.

Address of the President (Mr. T. R. Parker, of Napa, Cal.), Fifth Annual Meeting of the Pacific Coast Gas Association.

To the Members of the Pacific Coast Gas Association—Gentlemen:

Once more this sublunary orb has circled around its source of light and heat, and a hundred times has it traversed its orbit since William Murdock, in 1797, lighted, with the spirit of coal, his premises at old Cumnock, in Ayrshire, Scotland, although the birthplace of his experiment (the exact date of which is not definitely known) was Redruth, in Cornwall, England.

What a transition has taken place in one short century, within the possible compass of a human life, from this spot on the earth to the studded surface of the inhabitable globe, thus opening by his act an immense field for systematic, scientific investigation, and practical, mechanical and engineering skill.

What an army of humanity it put in motion, delving in the earth's crust, to supply the demands of this vast and still growing industry. Mines of coal, of iron, of lead, of copper and zinc; banks of clay and lakes of oil. A world to be piped, a world to be lighted by this medium of stored solar energy. An avenue opened for the toiling millions that offer in the world's market their only capital, labor; a field of exploration for the genius of invention, as well as a prominent cause for bringing to the front men made illustrious by their persistent diligence in research of natural phenomena, thereby adding to the store of human knowledge and the advancement of civilization.

It has extended the latitude of the laboratory, increased the capacity of the workshop and enlarged the field of engineering. The scientist and the artisan have vied with each other in developing and presenting the results of their research and attainments. It has been a splendid, brilliant contest of brains and energy. As a medium of investment for accumulated capital, and a stimulus in the science of finance, it has proven to be one of the largest manufacturing interests in the world today. Over $500,000,000 are invested in the manufacture of gas in the United States alone; and, in Europe, London and Paris represent an invested capital of well over one-fifth of that amount. This is a tremendous showing for an industry in existence but 100 years; and to be chosen to preside over an Association composed of representatives in this great department of manufacture is a compliment that I very deeply feel. I thank you, gentlemen, for your generosity.

But great as is this source of support, it has, by mistaken legislative and municipal zeal, at different times and places, received severe treatment, threatening, at times, to paralyze it as a source of legitimate income or suitable security for investment. Rates reduced, without action to investigate local conditions and supplies on which its rates are based. That, together with the advent and fostering of a competitor in the field for public patronage, has had its effect. Necessity driving active brains to protect and preserve the properties under their charge and maintain their positions, called on the arts and manufacture, on science and chemistry, and whatever developments of human thought and ingenuity could devise, that were applicable to the cheapening of existing processes. All departments underwent the crucial examination for curtailment, to conform to these mandatory edicts and changed conditions. Processes once tabooed were investigated, legal restrictions removed, systems improved and installed; the chemistry of flame and combustion was studied, better understood and adopted. Cheaper modes of purification and revivification, requiring less material and consequently less labor. Increased illumination sought for and found; more intelligence required in the retort or generating room; more perfect apparatus, and better understanding of its management; more application of scientific principles, and more commonsense invited.

Managers, whose chief boast was the length and not the character of

service, who failed to note the progress of passing events, or arouse themselves to a proper appreciation of the necessities of the hour, were invited to retire to the shades of private life to make room for more intelligent direction and practical application.

That genus homo, familiarly known as the "Gas House Tarrier," was relegated to the shades of the past, or to swell the ranks of the unemployed, or to help decorate some of the many institutions of public munificence. Labor, which formerly constituted the largest item on the payroll, shrank below that of the clerical department in some of our largest establishments. It has had the effect of calling on the trained and practical artisan, instead of the hard work of plodding muscle. These exertions are not estimated nor comprehended at their full value by the general public, or by those in large towns and cities, who are invested with the direction and power in public affairs.

Have these changed conditions ameliorated the situation? Are the investments of which we are the custodians made any more secure? Are we in any way protected from the damaging and ruinous attacks of the political demagogues, who use every available means to malign and magnify their own local and political influence, whose terms of endearment are soulless corporations, grasping monopolies, swindlers, etc., to inflaming the minds of those whose chief support is from the sources so vilified, becoming antagonistic, and at all times ready and anxious to abuse corporate interests, and by their thoughtlessness increasing restrictions on the possibilities of employment?

Is there any protection from the insidious planning of the conniving schemers or professional mountebanks to foist their processes, systems or methods on existing plants. Who, with bland suggestion, if not purchased, will submit their wares as a bid for municipal consideration, in many cases driving companies into over-capitalization or duplication of plant that would be totally unnecessary under legitimate protection?

These things demand our serious thought as the custodians of capital invested in gas undertakings. We should enlist the attention of the stockholder to pay proper attention to the primaries in their districts, to nominate men of sterling worth and integrity that wholesome laws can be enacted; that a feeling of security may prevail; that corporate interest may receive careful and just consideration. We fail in our duty when we remain silent or neglectful to exercise honest criticism or relax in our effort to secure reasonable and impartial legislation.

Do not let us fall into the position of a mutual admiration society or an annual recreation club, but bear in mind that the fundamental principles apply to us equally as well; that eternal vigilance is a very necessary qualification in our chosen profession. We must meet the issues of the times, and meet them manfully, fairly and squarely. Let us be sincere in our efforts to do right and assist in maintaining the principles of equity, justice and commonsense.

This may savor of federation; but the very first meeting of an Association of this character that has come to my knowledge was called by Gen. Charles Roome, President of the Manhattan Gas Light Company, of New York, Nov. 21st, 1859, held in that city, with the object of securing mutual protection and just and fair legislation at the State Capitol. There seems no question but that highly beneficial results could arise from the association and intercommunication of intelligent men, specially interested in the common welfare of this most important and growing industry. These lines have been dwelt upon from time to time by our Eastern confreres; and, I reiterate, on the Pacific Slope the sentiment should culminate in a movement for justice.

As to the events of the year that are interesting, the Exposition of Gas Industries, in New York City, was most notable. It was a treat to the fraternity that was more than appreciated, even by those who doubted a successful possibility. I hope it will take root in our country, to the extent of being duplicated in the near future, possibly in our own glorious territory. Our Secretary will entertain you with the results of his impressions while enjoying the privileges delegated to him as our representative.

A great amount of interest has been manifested throughout the Coast in the use of gas stoves and heating appliances, and inducements have been held out to consumers to accomplish this end by reduced rates for the purpose, and the introduction, at cost, of material appliances.

It is quite within the range of possibility that the labors of some one of the many experimenters may be crowned with success in producing a burner incorporating, as does the Welsbach, the feature of holding and consuming the carbon, producing thereby more heat for radiation by incandescence per foot of gas consumed, and be as far in advance for the purpose of fuel as the Welsbach is for the production of light.

I have a clipping, showing that our German cousins are alive in the matter of gas as fuel, and are in many respects well advanced, if not in the lead, in the matter of light, heat and power, which reads as follows:

"*The Greatest Gas Stove.*—The greatest gas stove in the world is probably that used at the celebration of the Hessian Agriculturists' Society at Giessen, where a whole ox was recently roasted in a gas stove. This was quite a novel barbecue, and was gotten up by the promoters of the celebration as a 'take off' on the ubiquitous advertisement, '*Koche mit Gas*' (cook with gas) which appears in almost every German paper and periodical. The colossal apparatus was arranged so as to admit the whole carcass of an ox weighing 1,100 pounds, which had for two days previous been pickled. This roast was done inside of seven hours as well as it possibly could have been over burning logs or coal. During the entire time crowds admired the huge gas stove and the perfection and neatness with which the operation was performed. After remaining all told ten hours in the gas stove, the roast was cut up into 800 portions, which brought in about 600 marks. The estimated cost of roasting an ox at a barbecue with log fires or coal fires was previously ascertained, and, after the operation was completed, it was found that gas was the cheapest fuel for such a barbecue. The total amount of gas used was 3,500 cubic feet, which, at the present price of gas, would cost in the neighborhood of $3.50. The Philadelphia *Record* says the experiment is to be repeated at Berlin next month upon a similar occasion."

Member Foveaux in dwelling on this topic will furnish food for thought and practice.

The Welsbach light is steadily gaining in favor, and has proven a most formidable rival to the arc in street illumination, by its economy and facility of blending at easy distances one light with another, giving a soft, clear and pleasing effect with ample accommodation, devoid of the dazzling, blinding glare of the arc, that is so perplexing to drivers and so dangerous to pedestrians. It is commending itself rapidly, as noticed by the seeking of those streets and avenues adopting this mode of illumination in preference to those lit by the long distance arc. Another great step in advance is the introduction of a new system for the instantaneous lighting and extinguishing of gas at any distance, or any number whatever of gas jets for public illumination. It gives to gas companies the means of lighting or extinguishing at will by means of a simple button, giving all the combinations of electric lighting.

Many of our companies who, with the idea of holding the area of illumination, have consolidated or absorbed their competitors of the current, thinking thereby to protect their field, find that they have assumed the maintenance of a current that, metaphorically speaking, turns a crank that revolves a medium that sharpens an edge that cuts the sack that dividends used to be drawn from. Becoming customers of electrical supply concerns, supporting the source by their patronage, and by so doing putting off the time of possible reduction of gas to a point to defy the competition they are now sustaining, enabling it to become more formidable, have surrounded themselves with and nourished an obstacle that blinds conception to find in what direction it is likely that profits and advantage will accrue.

I have not heard of any notable advance in the development of calcic carbide or its resultant gas, acetylene. It still interests and engages the attention of the world. The prepayment meter is attracting notice in the interior, establishing a better feeling and securing a class of consumers that could not be reached otherwise, converting slow paying consumers into sure pay, disarming the kicker of his most formidable weapon—a growl, and retarding premature old age and decay in the average gas collector.

The caulking machine for setting up joints in iron pipe has made its appearance, and is said to be doing work as effectual and more economical than is possible to be done by hand—all parts of the joint being caulked perfectly, evenly and expeditiously. It may prove quite an adjunct in the laying of large sized mains.

Statistics on oil producing wells could not be had this year, the companies interested preferring to be reticent in relation to output from wells.

By some unexplainable oversight no action was taken in that most excellent suggestion, so ably presented verbally and by charts at our last meeting—the adoption of a standard of dimensions and uniformity of castings throughout the Coast. I am satisfied that every member who provided himself with a chart is impressed with the importance of a standard, especially in cast iron pipe fittings, and I recommend the appointing of a committee to consider this matter of a standard of castings and the adoption of standard weights and measures, to govern as stated our Association in the future, the committee to report at this meeting. These suggestions were put with the best thought, and as

one of the advantages emanating from the action of these assemblages, for the benefit and accommodation of all.

We are about to be in the same predicament in relation to the duties on coal. At our second annual meeting the information then given was the fact (not generally known) that California alone has paid 80 per cent. of all the duties paid on coal in the United States. It rather handicaps gas companies that are confined to a quality of coal not mined within the confines of the State, or even in neighboring States. It affects us all, and pressure must be put to the extent of meeting this rise and maintaining per cent. on investments.

In addition to the papers mentioned, the "Spontaneous Ignition of Coal," by Mr. John L. Howard, calls attention to what moisture, compactness and want of ventilation will do with coal. What experience members may have had in this line, few care to recite as a narative of their acquaintance with this form of generating heat. It is interesting to those who have it to guard against, and to all who may hope never to be confronted with these conditions, and consequent possible action.

"Reminiscences," by Mr. F. H. Eichbaum, will cause many to look backward to the cause, circumstance or accident that placed them in the gas business, and the many scenes and changes that have transpired during their life as gas men.

"From Coal Gas to Natural Gas" is an experience of Mr. John Kempf, Jr., of Salt Lake, that cannot fail to interest, either as to theories of formation and storage, or mechanical triumphs and engineering skill that succeed in forming connection under adverse conditions in many cases of excessive pressure, or its application to the needs and comforts of humanity.

"The Welsbach Light," by Mr. G. I. Kinney, is a very thorough and comprehensive paper concerning the most essential points as to the advantage of uniform pressure and candle power of gas, giving the results of careful observation and experience.

"Incandescent Gas Lighting; a Comparison," by Mr. W. W. Gillespie, will cover his thoughts on this subject as an electrician, and his experience with the Welsbach light, as superseding the electric bulb, as to volume of light, steadiness and reliability.

"Small Lighting Plants and Their Management" will be dilated upon by Mr. Thomas D. Petch. This subject, always acceptable, brings out the points of careful treatment of detail which are of prime importance in order to provide for return in the shape of dividends.

"Practical Suggestions," by Mr. Chas. E. Burrows, will depict the comprehension, observation and practice that come of long service in the business. I regret his inability to attend the meeting; time and distance being the hindering factors.

"Uniformity of Accounts," by Mr. C. O. G. Miller, is the result of a task recommended at our last meeting, and shows how painstaking he has been in the system presented for your consideration.

"Municipal Control," by Mr. C. W. Quilty, is a subject that has excited considerable controversy of late years, and the author will ably set the matter forth. I hope his efforts will be productive of substantial recognition.

"A Short History of a Long Life," by Mr. C. M. Converse, gives the results of careful supervision and judgment in the construction and care of regenerative benches, presenting a report as to service performed per mouthpiece during the existence of the settings, very seldom equaled, taking yield as a basis.

"Recuperative Benches for Coke and Coal Firing," by Mr. D. R. Russell, are something new on this Coast, so the author will give to us a much desired piece of information. I refer to the practicability of using coal as a means of maintaining working heats, thereby enabling the substitution of a cheap coal for furnace firing, leaving the coke, which commands a better price, for the fuel market.

"Card Book-Keeping," by Mr. V. Stow, may be a valuable auxiliary to the paper on "Uniformity of Accounts," by Mr. C O. G. Miller, the subject being well worthy of examination. The idea put in practice by our Secretary, in the matter of sending in advance to the members the questions, I think is commendable, giving ample time to consider and present an acceptable answer, or to open up the possible betterment of the question.

The "Experience Department," instituted as a feature at the suggestion of the present Editor, for the purpose of collecting knowledge that might be gathered, found useful and valuable, will present the results of his labors. Benefits should flow from this source, demonstrating the oft-repeated saying that the humblest workman, whose means of observation may be greater than that of the engineer in charge, may impart, as an experience, some fact unknown to others, points brought out, information gained, that are not and cannot be reached by theories, but only by that dear old teacher, Experience; some deduction, which will assist those who have encountered the same difficulties, or who desire to take advantage of improvements, that may be mentioned as an experience.

The Editor has sent his appeal knowing that there must be many ideas, not fully put in general practice, that have been worked out and should be made known if successful. But there seems a reticence existing among members to ventilate their experiences in public, through their being inclined to be silent. As Ruskin says, "I cannot analyze that cruel reticence in the breast of men which makes them hide their deeper thought."

I would suggest that in future, as is the case with the Question Box, that neither name nor place be mentioned, but simply the experience given; as an experience that might prove valuable, but well to avoid, might place the "experienced" in rather a ridiculous light—a sort of an initiation laughable to the practiced one, but concentrated seriousness to the one getting his education on the "Experience Route."

Using the words of the Editor: "What should be furnished in this Department should be of such a character as would impart information to the members, showing what would be well to use and what should be avoided in order that dividends might increase, the manipulation of the plants made more easy and pleasant to managers and employees." This Department should receive the hearty co-operation of all and contributions should be tendered throughout the year.

The Wrinkle Department, edited by Mr. M. C. Osborne, exceeds all previous attempts in this line. The members may feast themselves on the results of his gleanings and return to the scenes of their labors better informed and prepared with handy conveniences that are conducive to comfort, and affording certain facilities suitable for required purposes.

These, I believe, comprise all the topics to be presented at this meeting.

Through the medium of the AMERICAN GAS LIGHT JOURNAL, the official organ of our Association, the papers heretofore presented, and discussions pertaining to them, have gone all over the world, and have been favorably commented upon by other periodicals furnishing gas literature, conferring thereby honor and distinction upon their authors, and to us a satisfying pride.

Our Association has made its mark among the Gas Associations of all countries, and it is a source of pride to be adorned with that circle of pipes, our emblem of fraternity, and, I hope, the open sesame to every gas man's heart and hand, wheresoever located. I hope, too, it will stand as a damper to the amalgamation of other interests in Association matters, for all that we have, as well as all that we are, is the result of labor and thought in the gas business.

It affords me much gratification to state that, as far as known, no deaths have occurred among our members since the last meeting—something remarkable, considering our numbers.

In conclusion, gentlemen, I thank you for your patient hearing and ask your assistance and indulgence in the discharge of the duties before me, that the meeting of '97 may be as eminently successful as those that preceded it.

Spontaneous Ignition of Coal.

[A paper read by MR. JOHN L. HOWARD before the Fifth Annual Meeting of the Pacific Coast Gas Association.]

For the proper presentation of the subject assigned me I felt it incumbent to go beyond some personal experiences and data gathered from time to time into a more general examination of the literature on the spontaneous ignition of coal, and to put before you some facts, as well as some theories and statements, that have come down to us from those who have made scientific investigations of the subject.

Before entering upon the treatment of the topic I may excite the curious interest of at least some of you, when stating that, prior to the middle of the present century, there was a quite general belief in the theory of the spontaneous combustion of the human body, resulting from the excessive use of alcoholic liquors.

The occurrences which formed the basis of this belief were described with circumstantial minuteness and discussed in European magazines; more than this, many of the cases were vouched for by surgeons and men of credibility, to various scientific societies in Europe.

Indeed, as late as 1861, *Blackwood's Magazine* contains 18 pages of double column, devoted to the needless refutation of statements that, in so far as they may be truthful, describe cases of accidental death, and the theory founded upon these occurrences by men of scientific attainments, would scarcely have been creditable to the superstitious era of the Middle Ages.

Statements of an earlier period are in existence, to the effect that

flames often burst from the stomachs of persons in a state of intoxication, and a drunken soldier was seen to die after an eruption of flames from his mouth.

Those present here may feel reassured upon learning that this was the result of the quality of liquor used previous to this century, and that the cases cited are chiefly those of drunken old *women;* but in these latter and more enlightened days, that produce a different quality of stimulants, although many in the same manner invite the fell destroyer, he does not come, torch in hand, to touch them off, that they may consume as a fuse and leave an incinerated mass as a horrible text for the lecturer on total abstinence.

Again, an editorial published in the *Coal and Iron Record*, June, 1875, states, in substance, that there never has been a case of legally proven spontaneous combustion in ships, yard or mine; all cases alleged to be due to this cause being properly attributable to incendiarism, the dropping of a match or lighted cigar or pipe, or other accident. It might puzzle this iconoclastic writer to account for the presence of a coal fire 12 feet below the upper surface of a pile.

If the true cause of spontaneous combustion be ascertained, as I think it has been, there may be a more intelligent study of means for its prevention and control, although it must be confessed that, in these latter respects, but little if anything of a practical character has been accomplished. Observation and experiments have established beyond question that *there is greater liability to self-ignition when the coal is fine and when the mass is deep.*

In the process of loading ships with bituminous coal, that may or may not have undergone a hurried screening at the time of shipment, it will be found that, whether the coal be dropped from a chute or spout that overhangs the hatchways of the upper deck, or whether the coal be lowered through the hatchways and dropped in the hold with a minimum of fall, the forming pile will assume the shape of a cone. In this process there will be breakage, dependent upon the friability of the coal and the amount of fall. This breakage will be sensibly increased if, in addition to the drop, the coal is allowed to go into the ship with a velocity due to the steep incline of the loading chute.

There will be a shattering of lumps and a compacting of the mass be cause of the impact of blows from the falling body of coal. It will be further noticed that the fine coal resulting from this method of loading ships lies in an inert mass where it falls, whereas the tendency of the lumps is to roll down the sides of the cone toward its outer edges. It is this coarser material which the stevedores move in the filling and trimming of ships, and, therefore, the undisturbed fine coal, resulting from the loading of a cargo, is concentrated under the hatch openings, and it is in this fine coal that fires on shipboard uniformly occur.

It must be obvious also that the larger the vessel the deeper the hold, the greater the breakage and the more dense the accumulation of fine coal, hence it has been noticed, from the reports of coal carrying vessels whose loss has been traced to the spontaneous ignition of cargoes, that the percentage increased in a rapid ratio with the increase in the size of cargoes. The loss was nearly double, as between vessels of 1,500 to 2,000 tons and of those beyond 2,000 tons.

Let us follow the practice of unloading these coal cargoes and their storage where business necessities require large deposits, and where, to economize in expense and in space, deep masses are piled around the wooden supports of the protecting sheds and of the overhead tramways.

The first coal that is taken from the ship is the fine coal lying beneath the hatchway openings, and before the bottom of the vessel is reached, this fine coal, together with such lumps as have rolled into the cavity made by the stevedores, will have been sent on shore, and with this fine coal the process of cone building begins in the storage sheds. The amount of fine coal originally in the ship is increased during the piling process on shore, and this is often covered by the coal subsequently discharged.

Here, as on shipboard, spontaneous ignition is found to take place in the mass of fine coal below the surface of the pile, and if there be pieces of wood, or the wooden supports of a structure, embedded in the mass near the affected portion, the firing of the coal will be expedited, because wood will ignite at a lower temperature than will the surrounding coal. Here, then, we have the most fruitful *source* of trouble.

Let us now examine some of the theories concerning the deeper lying *cause* or *causes.*

Spontaneous combustion of coal is due to the chemical combination of oxygen (1), with compounds of sulphur found in coal, or (2), with the carbonaceous parts of the coal itself.

The sulphur theory will probably be found to be the one popularly accepted, as indeed it was made the scientific theory, by the noted Swedish chemist, Berzelius, who died as recently as 1848.

The investigations of Dr. Percy in England, in 1864, and of Dr. Richters in Germany, in 1870, went to clearly prove that, as a working hypothesis, it did not account for all the discovered facts; and, therefore, it had to give way to newer scientific deductions.

Iron pyrites or disulphide of iron, which is disseminated in greater or less degree throughout coal, is the only sulphur compound there found, which, by oxidating under favoring conditions, will gradually develop heat sufficient to make its self ignition a possibility. Sometimes, however, the pyrites will rapidly oxidize, and at others it will remain unchanged for a long period.

Many coals almost free from sulphur are notoriously dangerous, while others known to be heavily charged with it have proved themselves to be quite safe for transport and storage.

The sulphur theory will not account for the self ignition of freshly made charcoal, nor of hemp cotton, nor of wool, when saturated with animal or vegetable oils and subjected to favoring temperatures.

The recent conclusions seem to point out that pyrites is merely accessory to the trouble, in that through oxidation it lowers the point of ignition in the surrounding mass of coal, and in the process it swells, causing disintegration of the lumps, and consequently increases the absorbing surface of the coal. It was found by test that sulphur would take fire at 482° F., whereas cannel coal ignited at 700° F. and Cardiff coal at nearly 900°.

The theory worked out by Richter, and now accepted as correct, may be briefly stated as follows:

Two of the constituent elements of bituminous coal, viz., the carbon and hydrocarbons, have a strong attraction for atmospheric oxygen, and, under ordinary conditions, this absorption of oxygen will be in proportion to the surface exposed to the porosity of the coal and to the temperature of the mass.

It was found by experiment that some English coal absorbed twice its own volume of oxygen, and in a pulverized state this absorption equalled 2 per cent. of its own weight.

The superficial area of a cube of coal 30 feet in thickness is easily determinable, but not so if that cube be shattered into a mass of the character in which coal is found on shipboard or inland storage, and this inconceivably large increase of absorption surface is active in attracting and condensing the atmospheric element that consumes it. It must be remembered that oxygen so absorbed has been largely rid of the diluent nitrogen and, therefore, is better fitted for the process of oxidation which begins slowly, but at once.

In this process two actions are set up. The combination of the oxygen with what is called the *disposable* hydrogen in the coal to form water; secondly, the combination of oxygen with the carbon, forming carbonic acid gas, and heat is evolved as the result of both actions. In the initial stage it is not sensible, nor is it apparent as in the case of iron, where visible rust indicates the process. When this heat is subject to the cooling effect of the atmosphere, or when it can be conducted from its source, no danger is to be apprehended, but where the evolved heat is not so conducted or cooled, as is the case in a mass of fine coal, the temperature will rise and continue with accelerated rapidity as the ignition point is approached.

Experiments showed that under a low initial temperature the chemical action due to this combination was slow, but when it exceeded 100° F. the process was rapidly aided, and powdered coal, with an ignition point of 700°, was found to take fire in a few hours upon exposure to a steady temperature of 250°.

Here, then, you have the gist of the Richter theory—viz., the combination of atmospheric oxygen with the consumable coal constituents and under favoring temperature conditions.

This explanation will dispose of the natural inquiry as to why the surface of the pile most exposed to atmospheric oxygen, and to renewed supplies of it, should escape ignition, while the compacted mass in the interior and not so exposed should be more liable to the trouble.

It is certain this chemical action is going on in the surface coal, but in that case the evolved heat is counteracted by the coolness of the surrounding air; whereas within the pile the atmosphere is still, there are no cooling currents, and the fine coal itself acts as a non-conductor of heat.

It is also certain that the interstitial spaces between the lumps or particles of coal in the mass are filled with air carrying one-fifth of its volume of oxygen. The fact of such a fire is indubitable proof of the presence of oxygen, without which it could neither occur nor exist, and its maintenance is due to the drawing of air through the surrounding mass to the region of chemical activity.

From this it is obvious that in every pile of coal there exist two of the conditions that obtain in active furnaces. In the one case the com-

bustion is made visible and intense through the greater rapidity with which the chemical action is made to occur after heat has been first applied; in the other case combustion is as surely taking place, though not apparent until the self-evolved heat reaches a point where the conditions become identical.

In so far as I have had access to German and English publications on this subject, they treat of bituminous coals, and not of those that are partially or wholly anthracitic.

Prof. Vivian B. Lewes, who has handled the question with great ability, is of the opinion that the absorbed oxygen "rapidly commences to attack the hydrocarbons present in the coal, having apparently but little action on the carbon itself."

No sharp line of demarcation can be drawn between the anthracite and bituminous classes, but the distinguishing feature of the anthracite condition is the high percentage of fixed carbon and a low percentage of volatile hydrocarbons. If the first, and greatest, activity of the oxygen is with the hydrocarbons, how shall we account for spontaneous fires in cargoes where hydrocarbons constitute so small an element? We know that Welsh anthracite coal has heated in the ships "Orient," "Glencona," and in other vessels; and that, in May, 1897, the ships "City of Benares" and "Lodore," bound with coal from Cardiff to Victoria, were obliged to put into Montevideo; but yet there is no recorded instance on this Coast where either of these coals has fired in land storage, although they were piled for long periods in deep masses and with the maximum amount of breakage due to handling.

Large experience in these products leads to the conclusion that, as they come from the ships, Welsh anthracite coals will yield from 10 to 25 per cent. of screenings, dependent upon the friability of the material and the care or want of care at the shipping point; and the softer Cardiff coals have been known to yield beyond 40 per cent. of fine material that passed through bars ¾ of an inch apart.

With these, as with all coal cargoes, it is seen that the accumulation of fine coal is beneath the hatch openings; and in or near this point will be found the seat of trouble when it occurs.

It must be remembered that coal cargoes from Great Britain for California are obliged to pass twice through the tropics, and it has been noted that, within the influence of the Equator, there is a material rise in the temperature of the coal.

We know that iron pyrites abounds in some grades of Welsh anthracite coals, and this is largely owing to false economy, carelessness or indifference to reputation on the part of some shippers. We have had abundant evidence of partial screening, or the entire neglect of it, at the shipping point; but, although fires on shipboard with anthracite coals are happily infrequent, the conclusion would seem inevitable that when they do occur it is by the direct oxidation of the carbon, with the hydrogen and pyrites as subsidiary aids. Like results proceed from like causes.

The cause of spontaneous fires in anthracite coal where hydrocarbons exist in limited quantity is the same cause that produces them in bituminous coals where the hydrocarbons exist to a greater extent.

We may briefly now refer to some of the expedients that have been tried or suggested for the prevention and control of this evil. Certainly there is no more inviting field for ingenuity, seeing the great loss of life and property from this cause in the past, and the existing and increasing risk, owing to the larger size of vessels engaged in coal transportation.

There is a further economic reason, due to the steady rise in the rates of insurance, which has made the freightage of some British coals to our port prohibitory. Underwriters, because of costly experience, have charged increased rates, not only on dangerous coal cargoes, but also on the vessels that carry them. So true is this that Scotch splint coals from Glasgow, and North Wales steam coals from Birkenhead, that formerly came freely to us, can no longer be carried in British ships; and for these grades we are dependent upon Norwegian vessels that are not subject to English insurance rules.

So, too, many British shipowners are refusing to carry Wallsend coal, than which no other product from Australia is so well known in our market.

Primarily, to reduce breakage in shipment, and incidentally to avoid spontaneous combustion, the most extensive and expensive arrangements in the world exist at the coal shipping docks in Cardiff. There the railroad cars are unloaded into large vertical cylinders, which, by means of lofty, powerful cranes, are hoisted from their pits, swung over the hatchways, lowered into the holds and discharged through the bottom with the minimum of fall to the coal. At other places the same result is arrived at by lowering small coal cars or wagons into the vessels.

The most direct attempt at the prevention of heating was the use of an air trunk, placed along the keel and fitted with slat openings. This involved the idea of ventilation and cooling. In practice, it was often found to produce the condition it was intended to avoid, because, while it did not supply the cooling effect, it too frequently furnished the necessary amount of air to promote rapid oxidation and the consequent final heating of the cargo. This practice has been abandoned.

The Germans have a method of locating in coal piles vertical, air-tight wooden shafts, to conduct the generated heat into the atmosphere above. It was observed that when these were not airtight, fires often occurred at the point of leakage.

As to the means of controlling spontaneous coal fires, opinion has taken different and sometimes curious channels. For example: The creation of a partial vacuum on shipboard in order to get rid of the dangerous atmosphere with its oxygen; the coating of the coal with a non-oxidizable mineral oil to prevent access of the oxygen to the coal; the use of many pipes through the holds for the conduction of the heat, and in time of danger to permit the forcing of steam into the mass of coal; the carriage of materials on shipboard to generate carbonic acid gas and the use of a pump for its forcible distribution, as well as afterwards to exhaust it from the hold; the placing, under and about the hatchways of ships, of flasks containing liquid carbonic acid gas, and fitted with fusible plugs that will melt below the ignition point of the coal. The liberated gas would at first freeze and, within the region of its influence it would permeate and cool the mass of coal.

It was first suggested that each flask might be electrically connected with the cabin, and the fusing of the plug would at once report the fact and the location of trouble.

In storage on land, the structural supports embedded in coal should preferably be of iron, and the first and finest coal discharged from each vessel should be isolated and used, and not covered with other coal.

As far as time and space permitted, we have hurriedly gone over this important subject; and, in leaving it, we may sum up the conclusions which scientific investigations have thus far reached.

Spontaneous combustion is due to the chemical action set up between the carbon constituents and the atmospheric oxygen which is absorbed by coal; the volume of oxygen so absorbed depends upon the surface exposed and the porosity of the coal; the chemical action evolves heat, and when this heat is confined it results in a constantly increasing temperature, and this accelerates the process of oxidation; analyses will not distinguish between the safe and unsafe coals.

It is the deep mass of small and fine coal that constitutes the danger; and coals of a firing tendency are dangerous, some at one depth of pile and some at another.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. E. H. Whitlock has accepted a responsible position with the East Chester Gas Light Company, of Mount Vernon, New York, under the direction of Mr. C. L. Gerould.

Manager Edmund Fish is engaged in constructing a coal gas works, for the Peninsular Lighting Company, at Redlands, Cal. The Company, it is said, will put down 18 miles of main, of which 5 miles (the line to Palo Alto) will be of the fiber variety.

"W.," writing to the Journal, under date of July 23rd, in London, England, says: "You may be pleased to learn that the Vice-President of the Economical Gas Apparatus Construction Company, of Toronto, Canada (Mr. W. H. Pearson, Jr.) was very royally entertained at a dinner given in his honor, at the Whitehall Club, Westminster, London, on Thursday evening, July 15th. The entire programme was in every respect calculated to touch a gas man's heart."

At the annual meeting of the Seneca Falls and Waterloo (N.Y.) Gas Company, the officers chosen were: Directors, Archibald Parkhurst, E. W. Miller, F. Maier, P. W. Bailey and R. J. Dobson; President, F. Maier; Secretary and Treasurer, R. J. Dobson.

Mr. J. A. McCollum, formerly in charge of the plant at Riverside, Cal., has been appointed Superintendent of the Wright Gas Company, Lorain, Ohio.

The Newport News Shipbuilding and Drydock Company is making extensive additions to its existing large plant at Newport News, Va. One of the large additions underway is the erection of an extension to its machine shop, which will have a dimension of 100 feet in width

and 200 feet in length. This building will be used for the finishing and erecting of marine engines and other large machinery used in connection with the mammoth steel vessels which this Company has underway. The central portion of the building, which is to be 50 feet high, will be fitted with an electric traveling crane, capable of lifting and carrying a load of 50 tons. On either side of this central space will be located a gallery, arranged for small machines and fitting tools. The building is to have a steel framework throughout, and the roof is to be covered with corrugated iron. The Berlin Iron Bridge Company, of East Berlin, Conn., has the contract for furnishing and erecting the steelwork of the building.

THE authorities of Spokane, Washington, have renewed the contract for the public lighting of that place, by means of arc lamps, with the Edison Illuminating Company. The contract, which goes into effect September 1st, binds the Company to maintain 200 arc lamps of 2,000-candle power each, on an all night and every night lighting table, at the rate of $4 *per lamp per month.* The Edison Illuminating Company, of Spokane, seems to be quite a philanthropic institution; but how about its responsibilities to its shareholders?

A CORRESPONDENT at Paterson, N. J., forwards the following clipping from a local newspaper: "The gas and water companies of this city have been put to a great deal of expense and loss in replacing pipes destroyed by the trolley currents. These pipes look, as if they had been eaten away by acids. The men who control the trolleys are interested in the water and gas corporations so that up to the present there has been no litigation over the damage done. However, the responsibility of the trolley roads for pipes destroyed by their currents bids fair to be judicially determined. The water service pipe leading from the street main to the new building known as Odd Fellows Hall, has been pitted through electroysis to the degree that another service pipe was necessary. Workmen tore up the street the other day and removed the old pipe, which was very badly corroded, although in use only a short time. One of the Lodge Trustees said, when questioned by a reporter: 'We shall send the bill for the new service pipe, and cost of putting it in, to the trolley Company. If payment is refused we shall institute a suit to ascertain if these corporations can destroy private property, without settling therefor?' The outcome of the matter will be awaited with great interest, as the question is one that concerns every property owner on streets where trolley tracks are laid."

THE damage to the plant of the Rochester (Minn.) Company, through the recent fire, did not amount in money to over $300. Superintendent Ruff's management was clever enough to prevent any inconvenience to the residents on account of lack of gas to meet their demands.

IT really looks now that there is much more than talk in the proposition to amalgamate the different interests that supply gas in the cities of Pittsburgh and Allegheny, Pa. The old Pittsburgh Company and the original Allegheny Gas Company undoubtedly hold the key to the situation, and will dictate the terms of the merger.

WE regret to report the death of Mr. Henry James, for many years a Director in the Consolidated Gas Company, of Baltimore, Md., who passed away at his home, "Tower Hill," near Catonsville, on the afternoon of July 27th. Deceased, who had been prominent in the business and social circles of Baltimore (he was President of the Citizens National Bank since 1869) for half a century, was born in Cortland, N.Y., February 21st, 1821. In 1840 he came to New York city, engaging with Messrs. Phelps, Dodge & Co. as a clerk, and in 1842 he moved to Baltimore, where he represented with success his New York employers. In 1847 he founded the lumber firm of Henry James & Co., and later on originated the Pennsylvania Land and Lumber Company, of Williamsport, Pa.—this concern has been managed for some time by his son, Mr. Charles James. Deceased was possessed of great business talent, but his cleverness in that direction did not prevent him from being a man who reared and loved a large family, nor from exercising widely distributed and unostentatious charity. The funeral services were held at St. Timothy's Church, Catonsville, on the morning of July 30th, the Revs. T. F. Hall and Edwin B. Niver (pastor of Christ Church, Baltimore) officiating.

AT a special meeting of the Directors of the Consolidated Gas Company, of Baltimore, held July 30th, the following action, respecting the late Mr. James, was taken:

"At a special meeting of the Board of Directors of the Consolidated Gas Company, of Baltimore City, held at its office, No. 19 South street, this day, the Committee appointed to prepare resolutions on the death of Mr. Henry James, reported as follows, which report was adopted by the Board:

"1.—*Resolved*, That in the death of Mr. Henry James, the Consolidated Gas Company has sustained the loss of a trusted counselor, whose services as a member of this Board gave evidence of efficiency, ability and devotion.

"2.—*Resolved*, That in the death of Mr. Henry James this Board and the community have lost a good and public spirited citizen, who has left to his family and friends the example of a just, kindly and generous life.

"3.—*Resolved*, That the President be directed to transmit a copy of these resolutions to the family of the deceased.—N. T. MEGINNIS, Secy."

AT the annual meeting of the Fall River (Mass.) Gas Company the officers chosen were: Directors, Samuel T. Bodine, R. Morgan, Walton Clark, J. S. Brayton, J. A. Baker, C. M. Shove and Geo. P. Brown; President, John S. Brayton; Vice-President, Joseph A. Baker; Treasurer, Edward C. Lee; Clerk and Manager, Geo. P. Brown; Superintendent, Joseph E. Nute.

THE Kingston (N.Y.) Company will extend its main system through Hasbrouck avenue, west of Delaware avenue.

A CORRESPONDENT at Springfield, Mass., forwards the following, under date of August 1st: "At the annual meeting of the Greenfield (Mass.) Gas Light Company the usual semi-annual dividend was declared. The election for officers resulted in numerous changes. Mr. Franklin R. Allen, who has been President of the Company since the death of Mr. Rufus Howland, declined a re-election, as did Mr. Dana Malone, who served the Company as Treasurer since 1887. The officers elected were: Directors, Wm. N. Washburn, Dana Malone, W. A. Forbes, Franklin A. Pond and James D. Safford; President, James D. Safford; Treasurer, Alfred R. Willard; Clerk, William S Allen. President Gifford is a resident of Springfield, with the banking interests of which place he is prominently identified, and Treasurer Willard has been Superintendent of the Company for quite a period. It was determined to remove the offices of the Company to more commodious and suitable quarters in the Mansion House Block, and I might further say that the changes above named are in line with a more vigorous pushing or development of the Company's business.—C."

THE Hazelton Boiler Company of this city has made important improvements in the settings of the Hazelton, or "Porcupine" boiler. The new setting is of steel, lined with brick the entire height of the boiler. The furnace of the boiler is square, with square grate surface, permitting the arrangement of a number of these boilers in compact battery form, thus effecting a considerable saving in floor space. The furnace casing supports at its top a circular bracket or shelf, which in turn supports the circular upper jacket and its lining of brick. Sufficient space for expansion of the furnace lining of the boiler, which is also brick, is allowed in this construction, whereby said lining is relieved of the crushing weight of the superstructure, with the further advantage that any needed repairs to the firebrick lining can be made with the greatest facility. The firing front of the setting is embellished by an ornate cornice and fluted cast iron pilasters, rendering the general effect of the setting very attractive. A battery of these boilers, placed side by side, presents one continuous firing front the entire length of the battery. We understand that a number of these boilers, originally placed in circular brick settings, are being reset in the steel settings above described. Amongst the more recent work of this kind performed by the Hazelton Boiler Company is a battery of its boilers in the 25th ward gas works, Philadelphia, for the United Gas Improvement Company. A new boiler of 150-horse power, with a steel jacket and a square furnace, has recently been erected in the plant of the Newark (N. J.) Gas Company; and we are informed that the Newark Company contemplates resetting its other Hazelton boilers in the same manner. The Rochester (N. Y.) Gas and Electric Company has recently ordered a 500-horse power Hazelton for its plant, making a total of about 4,000-horse power of these boilers in that model establishment.

"OBSERVER" writes that the annual dinner of the proprietors of the Gloucester (Mass.) Gas Light Company, which was happily brought off on the afternoon of July 27th, in the guests' room of the Magnolia Hotel, was a most enjoyable reunion. Mine host Priest had left nothing undone that he should have done—as a model boniface; and the banqueters so voted. Among those who shared in the reunion were Mayor

Benjamin F. Cook, Hons. Robert R. Fears and Sylvanus Smith, Col. David W. Low, and Messrs. Geo. R. Bradford, George H. Perkins, Chas. H. Tappan, John A. Coffin, Edgar Marchant and Joseph C. Shepherd.

THE authorities of Worcester, Mass., are about to make an extensive scale trial of the Welsbach lamp for street illumination. The trial will require the placing of 200 lamps.

THE offices of the Citizens Gas Light Company, of Willimantic, Conn., and those of the Willimantic Electric Light Company as well, have been removed to the building of the Willimantic Dime Savings Banks—a change that will be greatly appreciated by their respective patrons.

THE new holder for the North Adams (Mass.) Gas Light Company is completed. It is of the two-lift order and has a capacity of something over 100,000 cubic feet. When Col. Richardson has completed the other improvements that he has mapped out at North Adams, the gas works in the Berkshires will be very close to date.

"OBSERVER" remarks it is an open secret that an interesting discussion occurred at the July meeting of the Waltham (Mass.) Gas Light Company, when the Directors were considering the declaration of the current half-yearly dividend of 3 per cent. The dividend (3 per cent. for the half year) was declared, and made payable the 1st inst.; but such action was not determined until some of the Directors had freely asserted that it was poor business to encroach on surplus. Their plaint was that "the loss incurred by the operation of the Company's electric annex had been greater than the profit gained on account of gas sales."

AT the annual meeting of the Beverly (Mass.) Gas and Electric Company the officers chosen were: Directors, S. W. Winslow, H. F. Winslow, A. N. Rogers and Chas. F. Prichard; President, Sidney W. Winslow; Treasurer and Clerk, A. W. Rogers.

THE United Gas Improvement Company, of Philadelphia, will install a water gas set for the Southbridge (Mass.) Gas and Electric Company. The contracts for the purifying boxes and storage holder were awarded to Messrs. R. D. Wood & Co.

THE feature of the annual meeting of the Northampton (Mass.) Gas Light Company was the report of the Superintendent, Mr. D. W. Crafts. Under his careful management, abetted by the support of President Clarke and Treasurer Banister, the gain in sendout was equal to 10.26 per cent. over the output for 1895-6. The main cause for this notable increase must go to gas stove account, over 400 stoves being now in use in Northampton. During the year 3,181 feet of pipe were added to the Company's main system. The officers elected were: Directors, Chas. N. Clarke, L. Clark Seelye, E. H. Banister, Jno. F. Starr and D. W. Crafts; President, C. N. Clarke; Treasurer, E. H. Banister; Supt., D. W. Crafts.

THE semi-annual dividend (3 per cent.) of the Malden and Melrose (Mass.) Gas Light Company is payable on demand.

A CORRESPONDENT sends us the following clipping from the Boston *Herald* of the 1st inst.: "A bit of rather sharp practice in filing a remonstrance with a City Council was made public this week in connection with a petition from the Brockton (Mass.) Gas Light Company for an approval of a proposed new location for its plant. It has been obvious for some time that this Company was handicapped by a limited amount of room, and the fact that it could not get a side track to its yard, and hence must cart all of its coal. After many negotiations it obtained the option of a location on the new made land of what was formerly known as 'Vinegar Swamp,' with ample side track facilities. It filed a petition for the approval of the City Council, according to law, and later a remonstrance came in. These were referred, and the Committee reported in favor of approving the location. Then one of the Aldermen expressed surprise that there had been no hearing on the remonstrance, and the Committee let out the fact that instead of giving a hearing, the facts had been quietly determined. It was found that the signers of the remonstrance had not the least objection to the location, but that they had signed in the interests of a man who was trying to sell his own land to the Company, and that he had represented to the remonstrants that there was a chance for them to make a little money for themselves by means of their objecting. This being explained the location was approved by the Board of Aldermen, and with the concurrence of the Common Council the result will be to give the Brockton Gas Light Company a decided advantage over its present position, and an opportunity to extend its facilities which it has long needed."

MR. L. F. MCCLURE, the recently appointed inspector of gas and gas meters for Kansas City, Mo., is fitting up the testing apparatus in a room in the City Hall which has been set aside for his especial use.

ON petition of Messrs. T. S. C. Lowe, L. P. Lowe, L. A. Lowe and others, an injunction has been issued restraining the proprietors of the Pasadena (Cal.) Consolidated Gas Company from selling at delinquent sale certain stock in the Company held by the petitioners, on which they had refused to pay an assessment of $8 per share. Petitioners allege that the assessment was levied for the purpose of depreciating the stock. Argument on making the injunction permanent will be had in the Los Angeles Superior Court.

AT the annual meeting of the Norwalk (Conn.) Gas Light Company the following Directors were elected: E. J. Hill, E. K. Lockwood, Eben Hill, John A. Osborn, John H. Ferris, W. F Bishop, R. H. Rowan, P. L. Cunningham and J. P. Treadwell.

THE Board of Directors of the Bristol County (R. I.) Gas and Electric Company have ordered that the gross selling rate be placed at $2 per 1,000 cubic feet, prompt payment (within 15 days) to entitle the consumer to a rebate of 10 cents per 1,000.

IN the reorganization of the Ogdensburg (N. Y.) Gas Company the following officers were chosen: President, George Hall; Secretary and Treasurer, John C. Howard; Manager, J. H. Findlay.

THE proprietors of the Oshkosh (Wis.) Gas Light Company have increased the membership of the Board of Directors from three to five.

A Method of Using Welsbach Burners without Chimneys.

In its summary of the proceedings of the last meeting of the Society of French Gas Engineers, the *Journal of Gas Lighting* says that, at the convention, M. Andre Coze described a patented device that had enabled him to discard the glass chimney and yet obtain a high duty with incandescent burners. He was led to make experiments because of the frequent fractures of glass rod and even Jena chimneys in street lanterns. He noticed that a mantle gave a fairly good light for six months when used without a chimney and under a high pressure of gas. The light was, however, unsteady in high winds. He then studied the course of the combustion in Welsbach burners, and tried the effect of placing above the chimney two small concentric cylinders, the inner of which was about the same diameter as the mantle, and was considerably longer than the outer cylinder. The light was decreased by the superposition of these cylinders; but when the supply of gas was diminished, the light regained its original intensity. A reduction of consumption had thus apparently raised the temperature of combustion. This effect appeared to find an explanation in the fact that the draught of the ordinary chimney not only exerted a pull on the mixture of gas and air in the Bunsen, but also on the outer air, which passed up the exterior of the mantle and cooled it. The cylinders, however, gave a stronger draught on the mixture within the mantle than on the external air, and thus diminished the cooling effect of the latter, and thereby the amount of gas necessary to raise the mantle to the temperature of incandescence. A Welsbach burner without a chimney was tested in the photometer, and gave its maximum intensity with a consumption of 3.07 cubic feet per hour. On placing two small concentric cones above the mantle, it was found that the same light intensity was obtained with a gas consumption of only 2.47 cubic feet. The cones thus brought about an economy of 0.60 cubic foot per hour, and gave a high efficiency to the chimneyless burner. The results given by such an arrangement in practice were then compared with those from a Welsbach lamp with chimney.

In the lantern used, two truncated concentrical cones were concealed between the reflector and the top of the lantern. The outer cone was 2.16 inches high, 2.75 inches wide at the base, and 1.77 inches wide at the top. The inner cone was 7.9 inches high, 1.57 inches wide at the base, and 0.79 inches wide at the top. This lantern was put at the fixed distance of 1 meter from the disc of the photometer; and opposed to it was one with an ordinary Welsbach burner with plain glass chimney. The distance of this burner from the photometer disc could be varied as required. A series of comparisons were then made—new and old

(*Continued on page 215.*)

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(*Continued from page* 214.)

mantles being used on both burners. It was found that the intensity of the light for a given consumption varied considerably with different mantles. The burner provided with the cones gave the best results at low pressures—viz., 7½-tenths to 10-tenths. It was assumed that the ordinary Welsbach burner, at the consumption which yielded the highest intensity, gave a duty of 1 carcel per 20 liters consumption (= 14 candles per cubic foot of gas). This was the duty found for it by M. Crova. On this assumption the burner provided with cones would give an average duty of 1 carcel per 18.5 liters of gas (= 15.3 candles per cubic foot of gas). If the ordinary burner with chimney had been assumed to have a higher efficiency than 20 liters per carcel, then the duty obtained from the gas by the cone device would also have appeared proportionately higher. The primary object of the trials was to find a means of avoiding the need for chimneys; and in attaining this object it was found incidentally that an economy of gas had also been achieved. The results had, therefore, an undeniable practical value.

Controlling Valve for Gas Burners.

Mr. F. R. Boardman, of Tottenham Court Road, London, England, is before the English Patent Office for letters securing him in the exclusive right to a controlling valve for gas burners. Mr. Boardman proposes to use two separately operated solenoids or magnets, each energized by an electric current when passing through its special circuit (separately operated by connection with a source of electricity) when it is desired to actuate the gas-controlling valve in either direction. One solenoid when energized is employed to lift its core or attract an armature whereby the valve is opened to admit gas to the burner; while the other is used to reverse the action and close the valve—the first circuit being simultaneously or previously broken.

When the core is attracted to a certain point within the opening solenoid, the gas valve is opened by a spindle connecting the core and the valve, so that gas passes freely to the burner. The spindle has an enlargement of ball form, adapted, when attracted by the opening solenoid, to press aside springs, and rest thereon with the valve in its opened position. When the closing solenoid is energized, the armature is attracted in the opposite direction, which closes the valve, and the gas supply is cut off. This form of enlargement again assists in pressing aside the springs which hold the valve spindle in its open position, and the valve drops upon its seat; the weight (in some cases) assisting the attractive action of the closing solenoid in shutting off the supply of gas to the burner.

The form of the burner and means of ignition may be of any convenient description; but in cases where a pilot light is kept burning by means of a bye pass around the main gas passage, these improvements are, it is claimed, of special utility, as the valve or its seat is easily formed with a small cut or indentation, so that a slight flow of gas passes through when the valve is upon its seat—thus supplying the pilot light as a means of ignition, but becoming merged in the main supply when the electrically controlled valve is fully opened.

The Market for Gas Securities.

The feature of last week's market for city gas shares was the soaring of Consolidated, which, on comparatively small trading, advanced to the high mark of 196½. Yesterday (Thursday) and to-day the quotations were considerably lower, the low point being 188. It is thought in well-informed quarters that legal proceedings may be instituted to delay the merging of the local gas interests, and while such action undoubtedly will depress prices temporarily, there can be no doubt as to the final result. The scheme for merging has suffered no material setback at the hands of anyone connected with it who could really block the negotiations. It is quite certain, too, that the Consolidated people are doing the dictating.

Equitable has maintained its recent advance; in fact, it has more than held up to its value, for to-day (Friday) 260 is bid, with a nominal asking price 10 points in advance. Mutual is 270 to 285, and his father's son very truthfully said this week that the property and business of the Mutual Company are very valuable. We have to apologize for the quotation that we give respecting Northern, of New York, but it represents the last official sale of which we have cognizance. We would like to take a lot of it at a *material* advance over the bid rate named. Other city shares are strong.

Brooklyn Union is constantly gaining ground. As we said some time ago, investors seemingly are not thoroughly alive to the remarkably strong position of that Company. Its earning power is remarkable. Chicago gas sold well above par, owing to the advancement of the consolidation proceedings, and the declaration of the quarterly dividend of 1¼ per cent. Lacledes showed remarkable strength, the opening to-day having been made at 39¼ to 40. On what this increase is based, save that the earnings for the last month show a good gain, we are unable to say. The preferred Laclede looks pretty high at 88.

Bay State is more animated than has been the case of late, the current quotation making it worth 16 to 16¼. Baltimore Consolidated is strong, at 59½ to 60.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

AUGUST 9.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	191	191½
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	260	270
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	270	285
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	89	91½
Preferred	2,000,000	100	115	118
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000		..
Standard	5,000,000	100	120	123
Preferred	5,000,000	100	125	135
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	121½	121¾
" " Bonds (5's)	15 000,000	1,000	114	115
Bay State	15,000,000	50	16	16½
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	90	92
2d " " "	3,000,000	1,000	74	75
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	102½	102¾
Chicago Gas Lt. & Coke Co.				
Guaranteed Gold Bonds	7,850,000	1,000	104	104¼
Columbus	1,000,000	..	78	80x
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	78	77
" Bonds	600,000	1,000	101½	103
Cincinnati G. & C. Co.	8,500,000	100	202½	203
Consumers, Toronto	1,800,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		..
Consolidated, Baltimore	1,000,000	100	59½	60
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	.	22	..
" Con. Bonds	4,312,000	..	72½	74
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	83	84
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	152	155
" Bonds, 6's	2,650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	94½	98
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	39½	40
Preferred	2,500,000	100	88	88½
Bonds	9,034,400	1,000	100½	101
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	142	..
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	79	81
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	82½	84
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Situation Wanted

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By an experienced Engineer in construction and the manufacture of water gas. Seven years with the United Gas Improvement Company; 2½ years with the Economical Gas Apparatus Construction Company, in Canada and England.

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As Superintendent of Gas Works,

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Receiver's Sale.

The undersigned Receiver of the late firm of William H. Berry & Co., of Woodbridge, N. J., will sell on the premises of the late firm, at Woodbridge, Middlesex County, N. J., the entire plant of said late firm, on Thursday, August 12, 1897, at 2 P.M. The property to be offered for sale consists of the land and buildings used for many years by the firm in carrying on the firebrick business, together with the presses, moulds, wheelbarrows, tools, clay, sand, office furniture, safe, and all other personal property; also, a large stock of firebrick, the goodwill and firm name of the late firm of William H. Berry & Co.

The attention of the trade is particularly called to this matter. Particulars and conditions of sale will be made known at the time of sale

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OSCAR KEEN, Counsel for Receiver.

July 6, 1897.

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NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

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Mich. Ammonia Works, Detroit, Mich.

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Consolidated of New Jersey,
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Grand Rapids,
New York,
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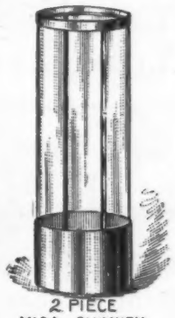

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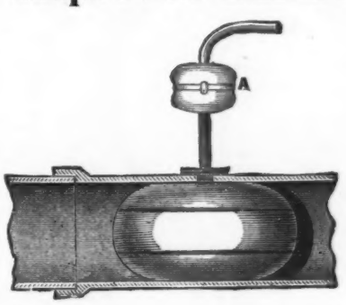

These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in. Gas Bag, each,			$0.60	12-in. Gas Bag, each,			$5.00
4 "	"	"	.80	16 "	"	"	8.25
5 "	"	"	1.05	20 "	"	"	12.00
6 "	"	"	1.75	24 "	"	"	17.00
8 "	"	"	2.65	30 "	"	"	27.50
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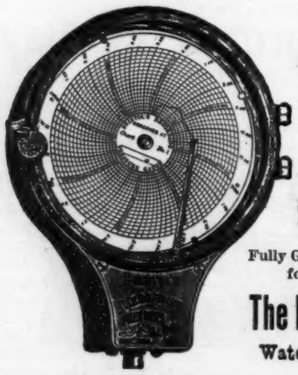

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Coke Cars, Tip Cars,

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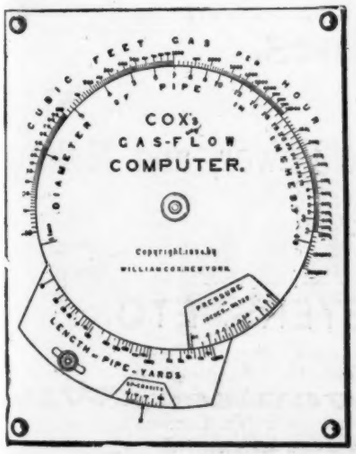

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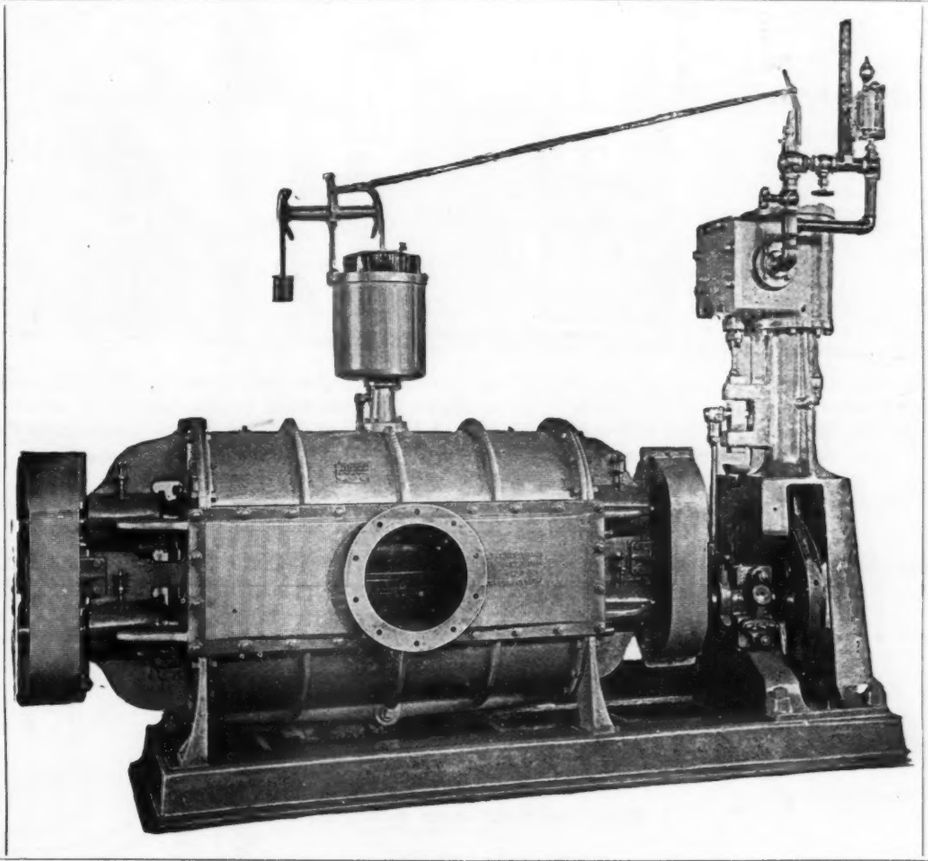
New Design of Direct Connected Engine and Exhauster on Same Bedplate.



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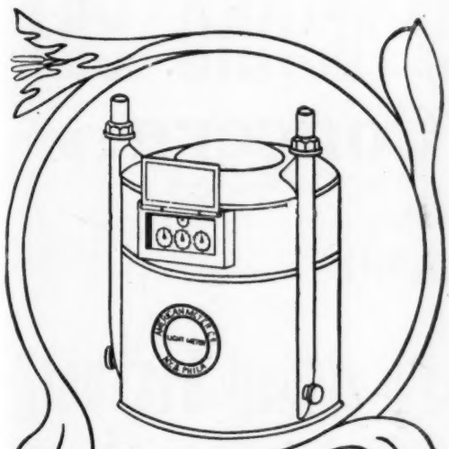

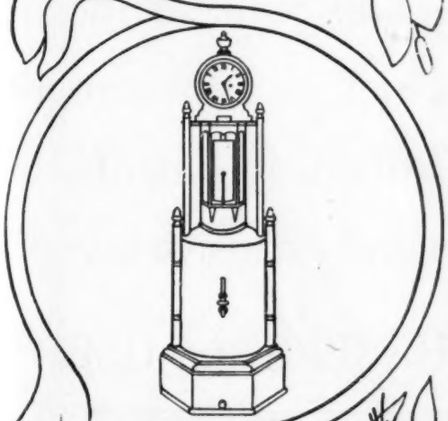

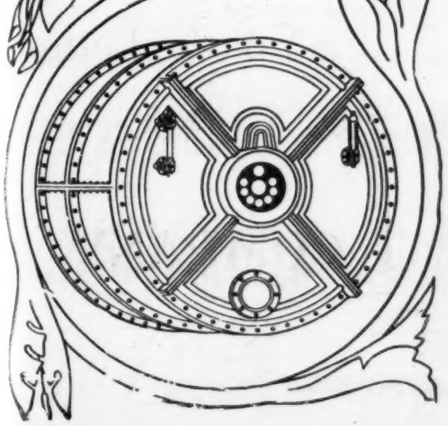

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CHICAGO, ST. LOUIS,

SAN FRANCISCO.

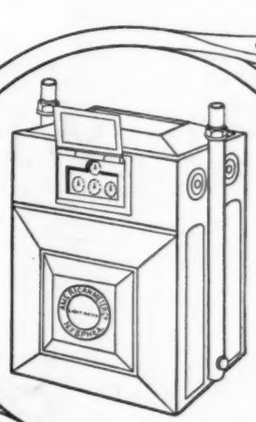
PUBLIC LIGHTING TABLE.

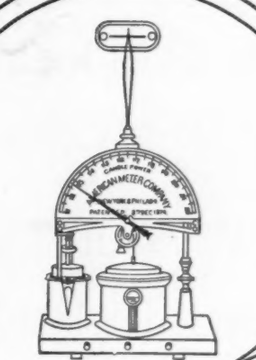
AUGUST, 1897.

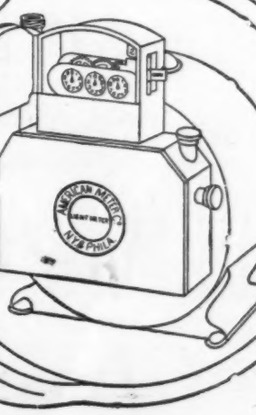
Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguist.
				P.M.	A.M.
Sun.	1	7.40 PM	4.00 AM	7.10	3.30
Mon.	2	7.40	4.00	7.10	3.30
Tue.	3	8.30	4.00	7.10	3.30
Wed.	4	9.00	4.00	7.10	3.30
Thu.	5	9.40 FQ	4.00	7.10	3 30
Fri.	6	10.30	4.00	7.10	3.45
Sat.	7	11.20	4.00	7.10	3.45
Sun.	8	12.20 AM	4.10	7.10	3.45
Mon.	9	1.40	4.10	7.10	3 45
Tue.	10	2.50	4.10	7.10	3.45
Wed.	11	No L.	No L.	7.10	3.45
Thu.	12	No L. FM	No L.	7.10	3.45
Fri.	13	No L.	No L.	6.55	4.00
Sat.	14	7.30 PM	8.50 PM	6 55	4.00
Sun.	15	7.20	9.10	6.55	4.00
Mon.	16	7.20	9.40	6.55	4.00
Tue.	17	7.20	10.00	6.55	4.00
Wed.	18	7.20	10.30	6.55	4.00
Thu.	19	7.20 LQ	11.00	6.55	4.00
Fri.	20	7.20	11.40	6.45	4.10
Sat.	21	7.20	12.30 AM	6.45	4.10
Sun.	22	7.10	1.20	6.45	4.10
Mon.	23	7.10	2.20	6.45	4.10
Tue.	24	7.10	4.20	6.45	4.10
Wed.	25	7.10	4.20	6.45	4.10
Thu.	26	7.10	4.20	6.45	4.10
Fri.	27	7.10 NM	4.20	6.30	4.20
Sat.	28	7.10	4.20	6.30	4.20
Sun.	29	7.00	4.30	6.30	4.20
Mon.	30	7.00	4.30	6.30	4.20
Tue.	31	7.00	4.30	6.30	4.20

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45







To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

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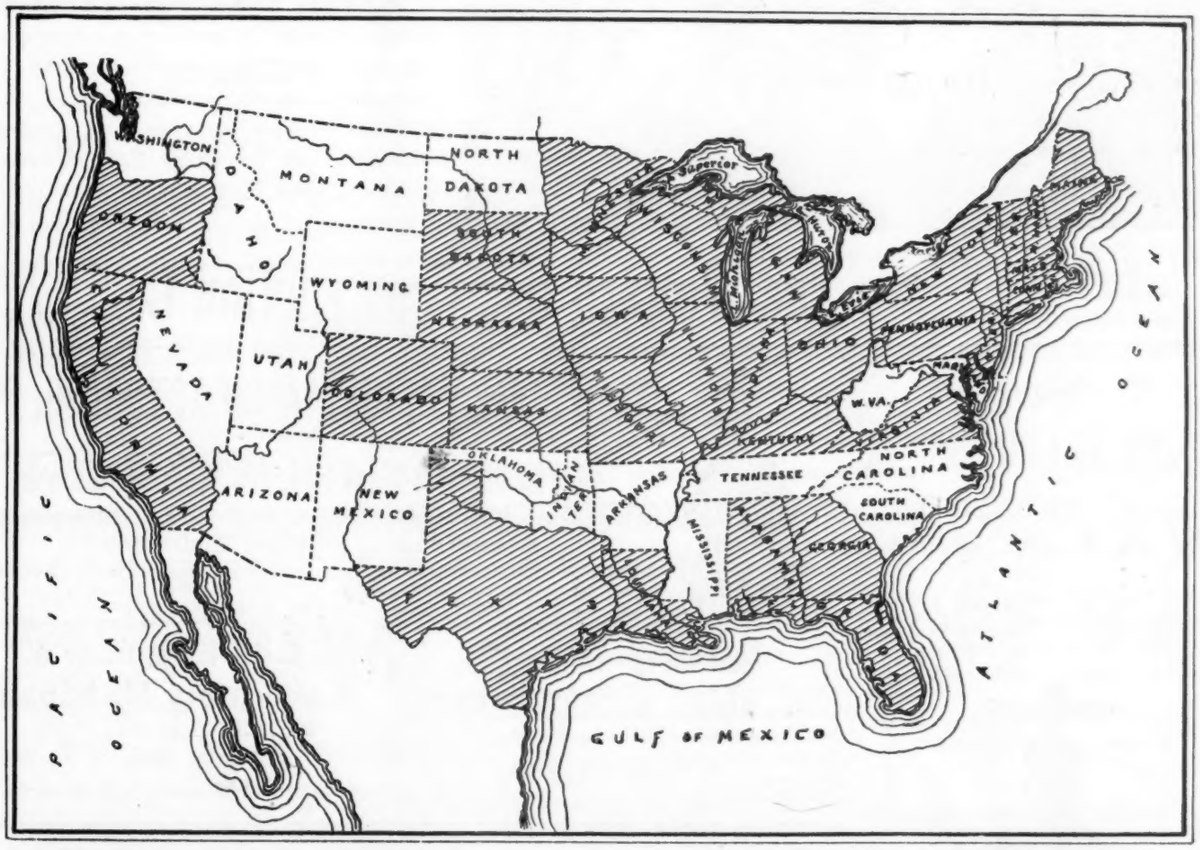

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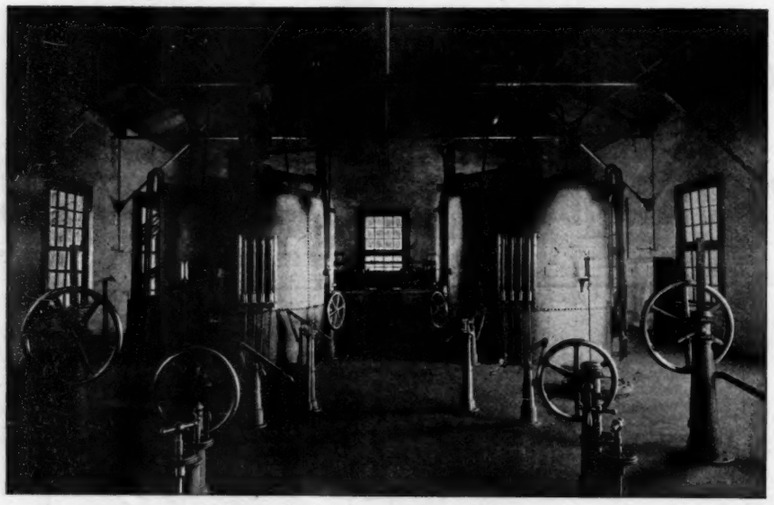

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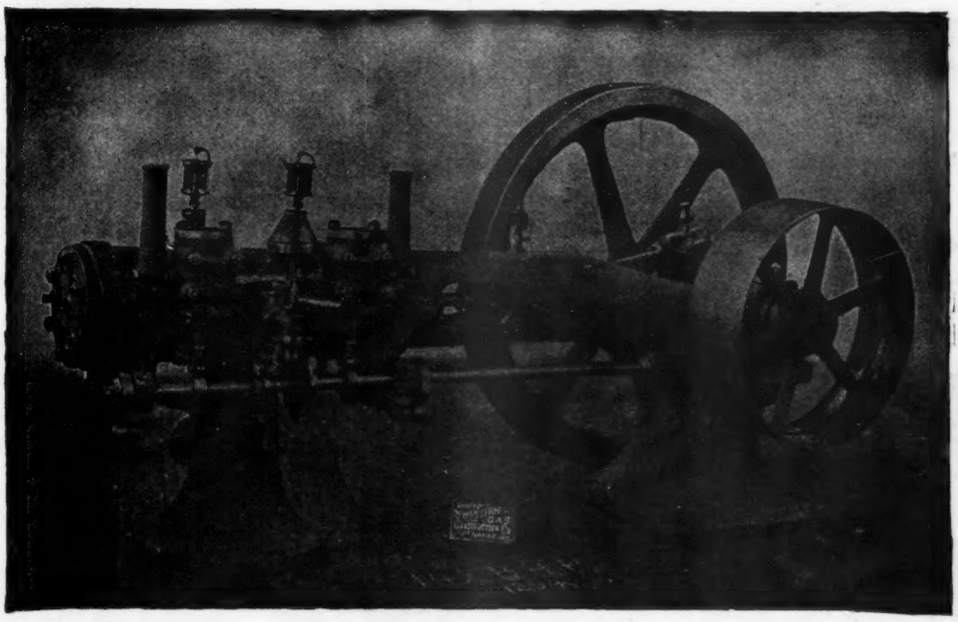

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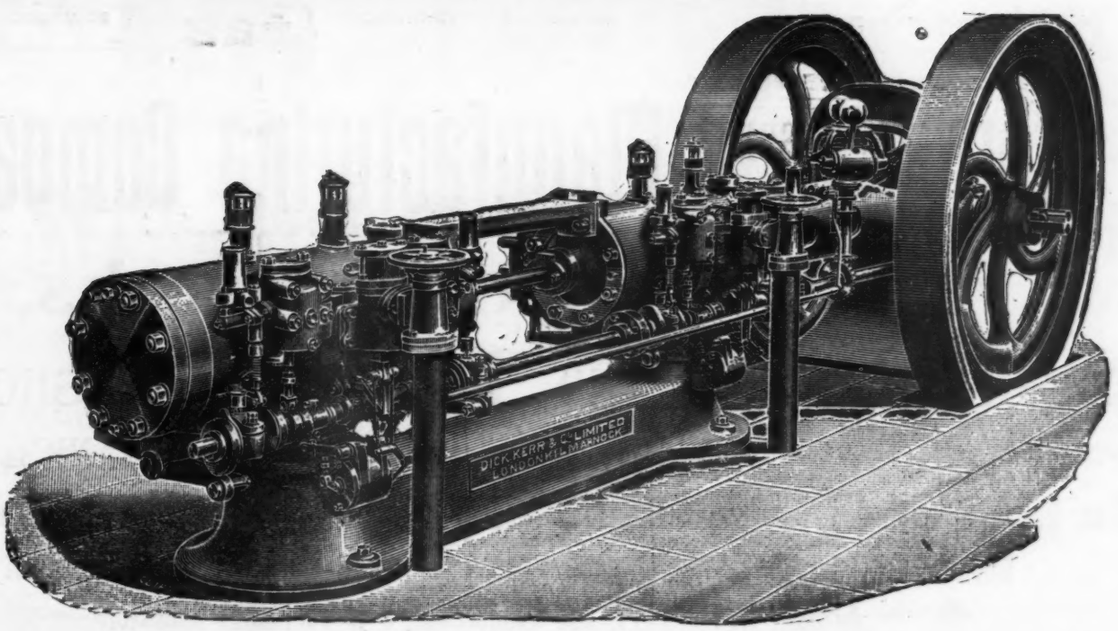

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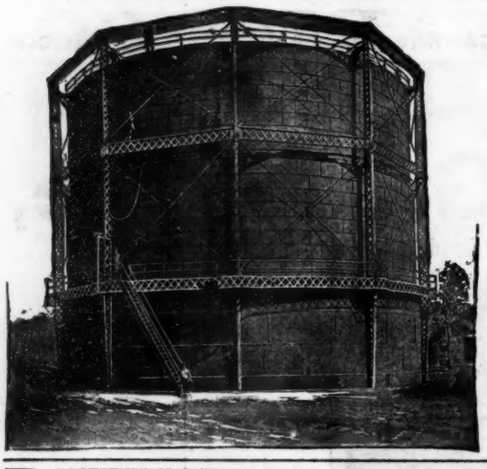

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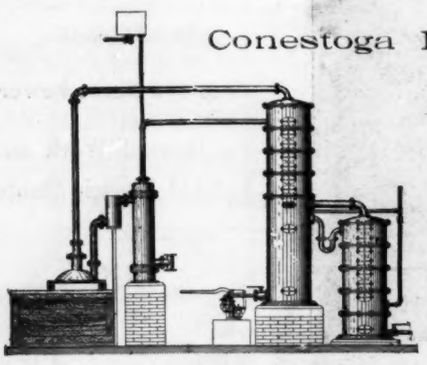

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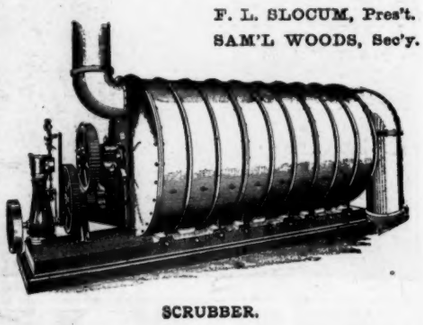

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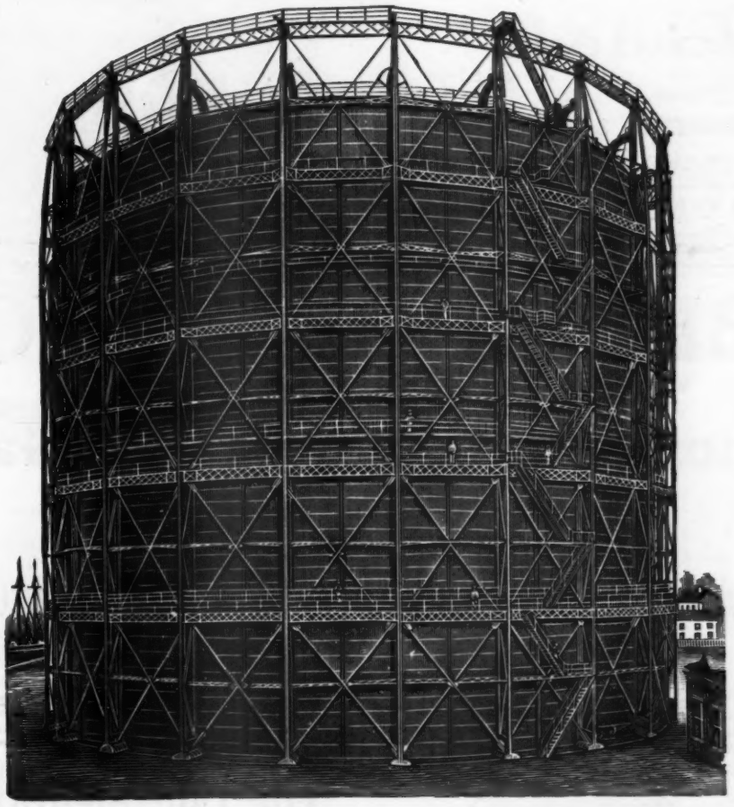

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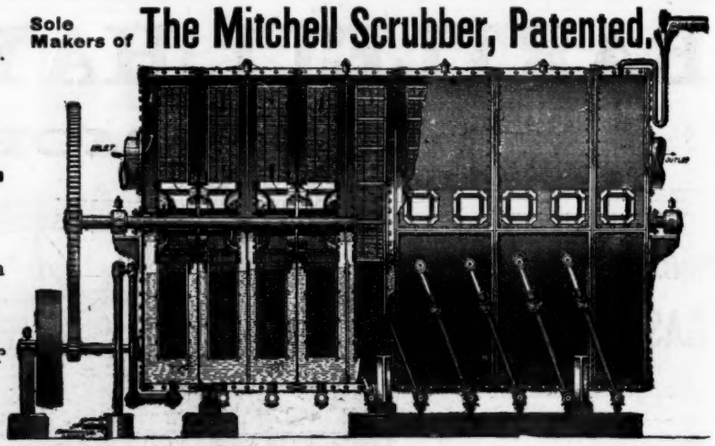

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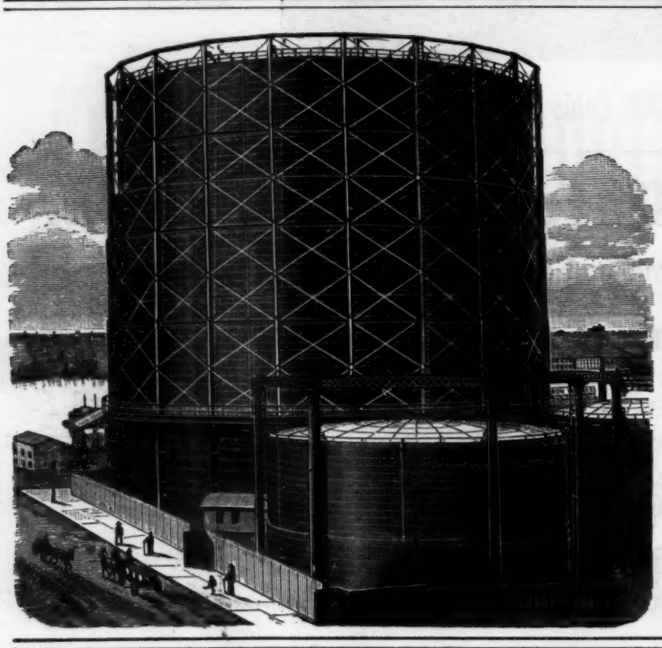

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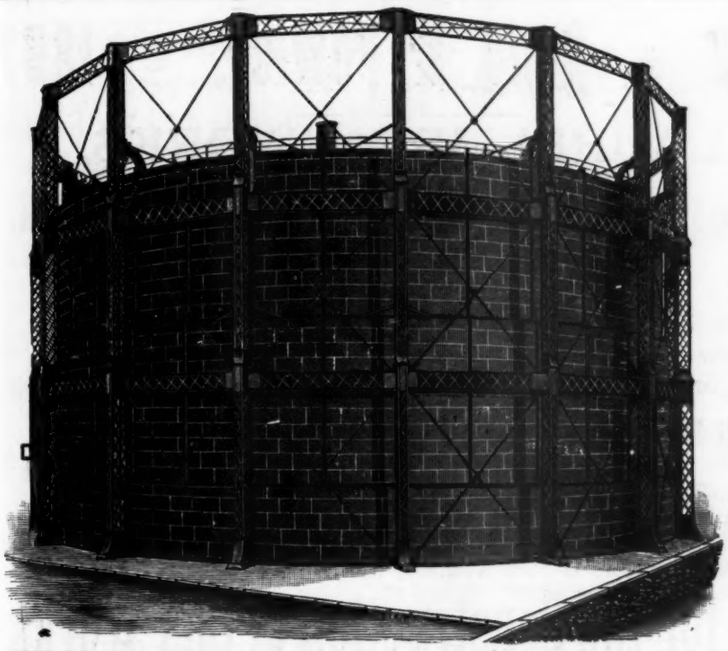

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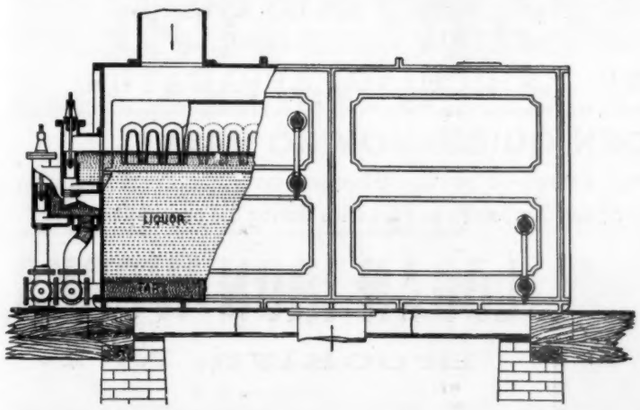

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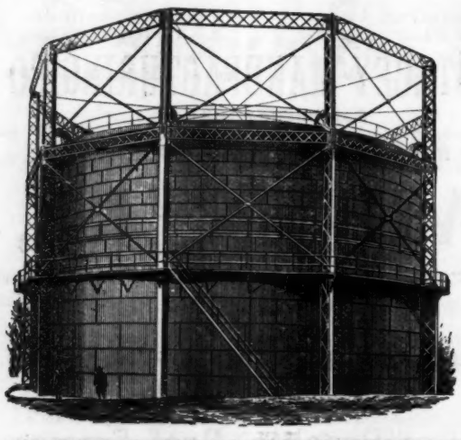

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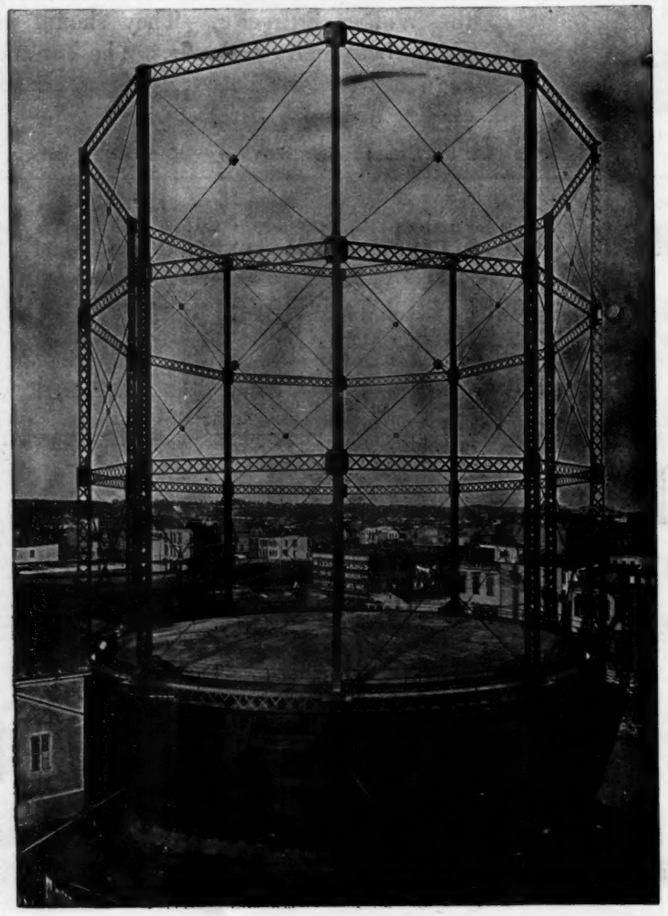

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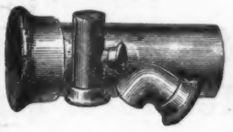

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